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NO. 122

SPACE FLIGHT OPERATIONS PLAN

MARINER MARS '64

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FOREWORD

It is the function of the Space Flight Operations Plan (SFOP) for Mariner Mars '64 to define the method by which the space flight operations will be conducted in both the standard case and anticipated departures from the standard case. Space flight operations are defined as the operations necessary to obtain and process spacecraft information and commands required by JPL during the portion of flight from launch to the accomplishment of the mission.

This addendum describes the plan for the Encounter and Postencounter period of the Mariner Mars '64 Mission.

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SECTION I

SPACE FLIGHT OPERATIONS FOR MARINER MARS '64

A. MISSION OBJECTIVES

1. Primary Objective

The primary objective of the Mariner Mars '64 Project is to conduct close-up (flyby) scientific observations of the planet Mars during the 1964-65 opportunity and to transmit the results of the observations back to Earth. The planetary observations should, to the greatest practicable extent, provide maximum information about Mars. TV, cosmic dust, and a reasonable complement of fields and particles experiments will be carried. In addition, an Earth occultation experiment will be carried out on spacecraft launched during the Type I trajectory launch period to obtain data relating to the scale height and pressure in the atmosphere of Mars. The project has the option of launching one spacecraft on a Type II trajectory and waiving the occultation experiment on Type II trajectories if, in its judgment, such action maximizes the probability of success of the total mission.

2. Secondary Objectives

There are two secondary objectives of the Mariner Mars '64 Project. The first is to provide experience and knowledge about the performance of the basic engineering equipment of an attitude-stabilized flyby spacecraft during a long duration flight in space further away from the Sun than the Earth. The other secondary objective is to perform certain field and/or particle measurements in interplanetary space and in the vicinity of Mars.

A tertiary objective of the Project is to provide a spacecraft design that is capable of repeating the same (or a similar) flyby mission to Mars during the 1966-1967 Mars opportunity with a minimum of modifications.

3. Space Flight Operations Objectives

The primary objective of Mariner Mars '64 space flight operations is to provide the necessary tracking, data processing and dissemination, mission evaluation, command generation, and command execution functions in support of the primary and secondary mission objectives.

On a noninterference basis, space flight operations may also meet the following secondary objectives:

a) Evaluate and compare spacecraft and tracking information received from the spacecraft with information obtained from ground observatories during the flight.

b) Provide information and experience on space flight operations and mission performance for use in future mission planning.

B. SPACECRAFT DESCRIPTION

The Mariner IV (MC-3) spacecraft (Figures I-1 and I-2), which is fully attitude stabilized, uses the Sun and Canopus as reference objects. The spacecraft derives its power from photovoltaic cells arranged on four panels which have body-fixed orientation and from a battery which is used during launch, trajectory correction maneuvers, and backup. The spacecraft has a two-way communications system that provides: 1) a method of telemetering information to the Earth, 2) command capability to the spacecraft, and 3) doppler and ranging for orbit determination. The spacecraft has a guidance system that permits trajectory correction maneuvers and a propulsion system that is capable of executing two such maneuvers. Since one maneuver has already been performed, the capability remains to perform only the second maneuver.

Both scientific and engineering experiments will be accomplished by the Mariner IV spacecraft. The science portion will be composed of both planetary and interplanetary experiments. A list of the experiments follows:

1) Planetary Experiments

   a) TV

   b) Earth Occultation

2) Interplanetary Experiments

   a) Cosmic Dust Detector (Inoperative)

   b) Helium Magnetometer *

   c) Ion Chamber *

   d) Trapped Radiation Detector *

   e) Plasma Probe (Semioperative)

   f) Cosmic Ray Telescope

3) Postencounter Engineering Experiments

   Some of the following engineering experiments may be performed, depending on the status of the spacecraft and encounter data retrieval.

   a) Propulsion

      Second Maneuver

   b) Attitude Control

      Inertial (Gyro) Control

* Also used for planetary experiments.

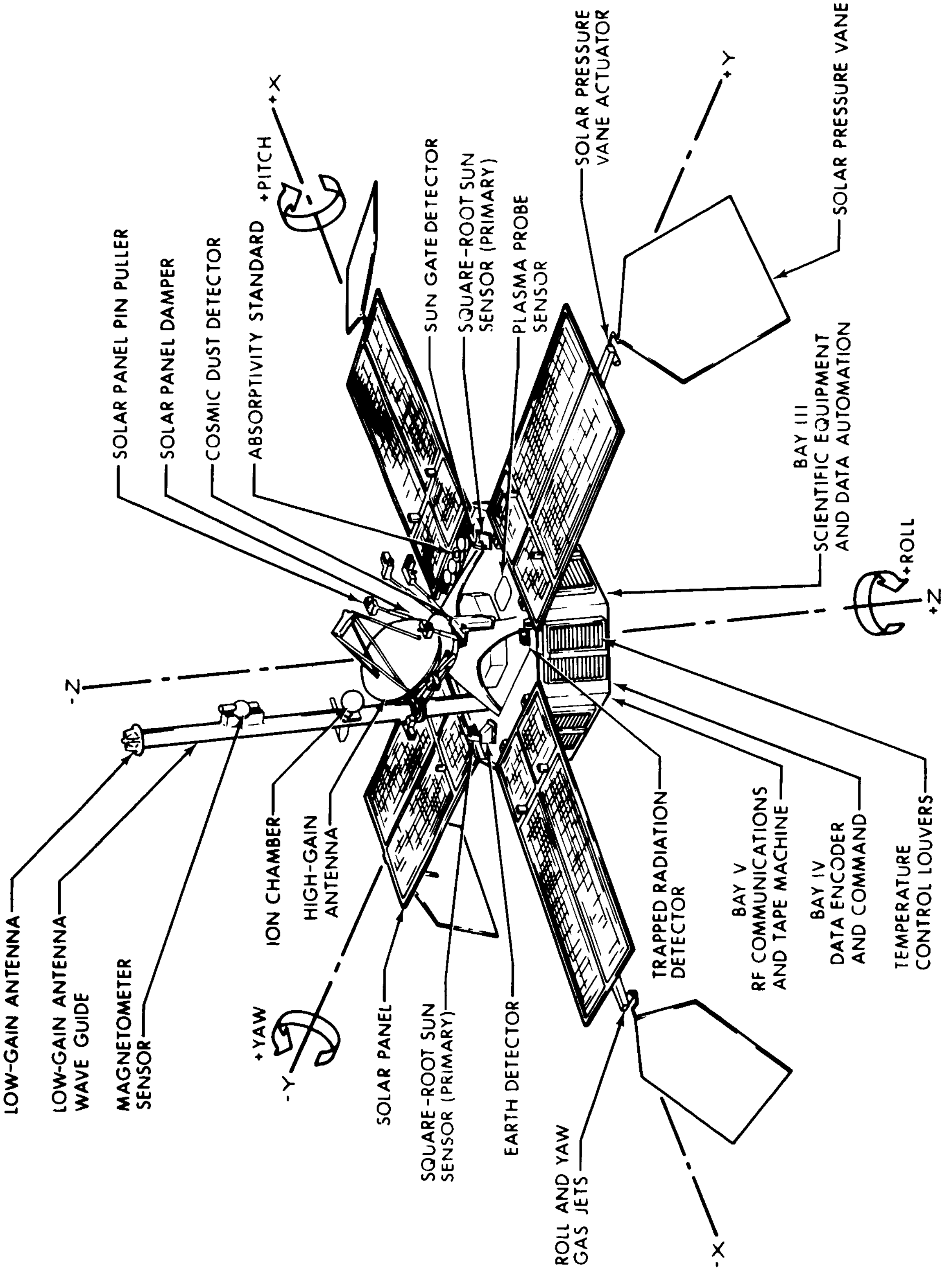


FIGURE I-1. MARINER C SPACECRAFT CONFIGURATION (TOP VIEW)

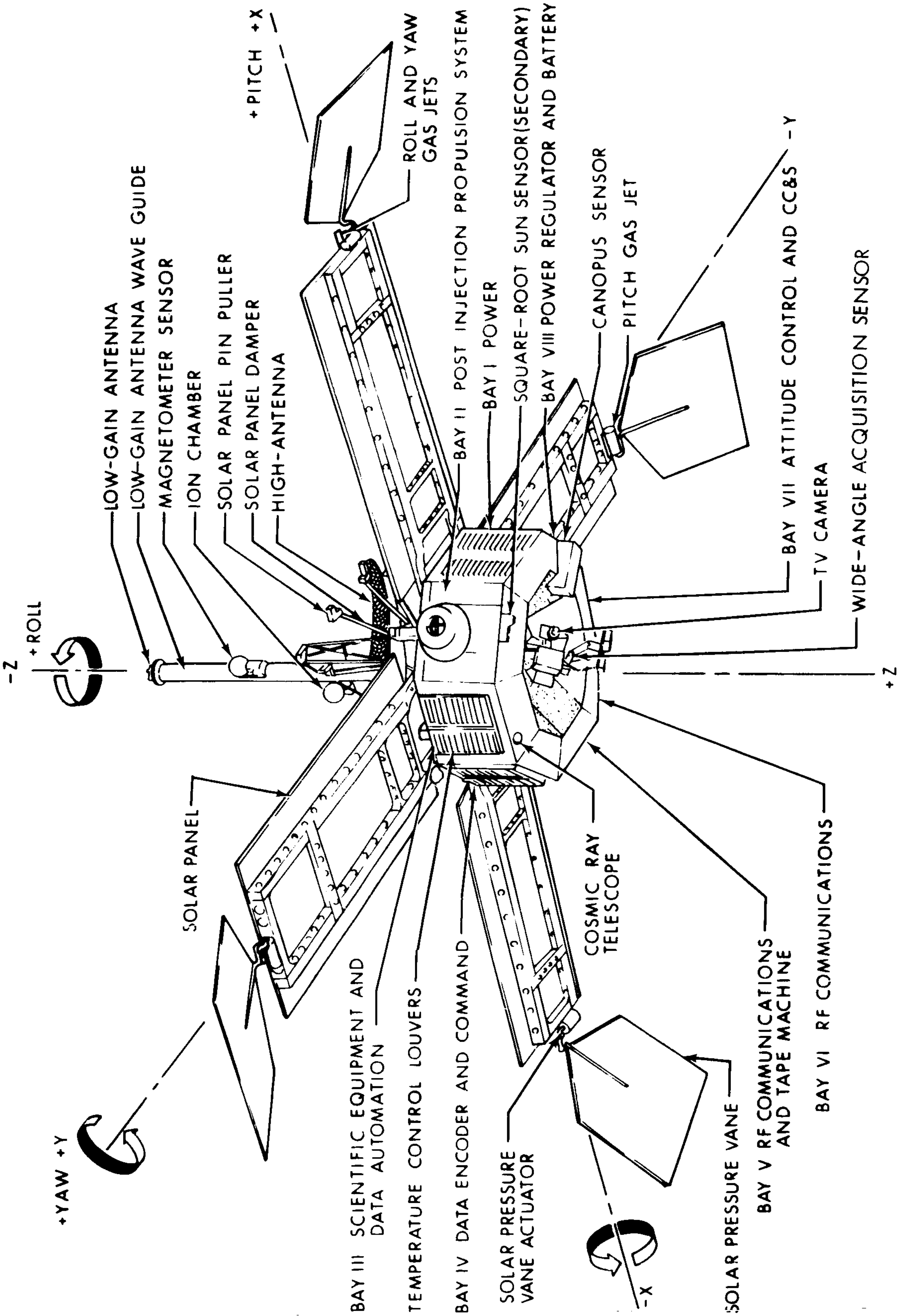


FIGURE I-2. MARINER C SPACECRAFT CONFIGURATION (BOTTOM VIEW)

c) Telecommunications

(1) Ranging

(2) Switch Exciters

(3) Switch Power Amplifiers

(4) Switch Telemetry Bit Rates

(5) Switch Transmit/Receive Antennas

(6) Switch Analog-Digital Converters and Pseudonoise Generators

C. MISSION PROFILE

1. General

Launch of the Mariner IV (MC-3) spacecraft took place November 28, 1964 from the Air Force Eastern Test Range (AFETR). A trajectory correction maneuver was accomplished on December 6, 1964. The spacecraft will make its closest approach to the planet, Mars, on July 15, 1965 at approximately 01:00:00 GMT and 5400 miles from the surface.

2. Encounter

The encounter period is defined as that period of time from ten days prior to closest approach through the complete recovery of all real time and stored planet data utilizing nominally two playbacks of the onboard tape recorder.

During the encounter period, the spacecraft will be continuously monitored, and tracking and telemetry data will be evaluated to determine exact encounter conditions. Any necessary commands to the spacecraft will be executed by the normal prime tracking stations or by the 100-kw transmitter.

The spacecraft TV data will be processed into unrefined pictures shortly after the reception of each complete picture at the SFOF.

3. Postencounter

Monitoring of the spacecraft will continue until the combined effects of increased range and spacecraft antenna pointing error have exceeded the RF communication threshold. It is planned to perform tests on several of the spacecraft subsystems including the performance of a second maneuver.

4. Spacecraft Encounter Sequence

The spacecraft flight sequence (Table I-I) shows the onboard spacecraft sequence from the initiation of the encounter sequence through the first complete TV picture playback.

TABLE I-I. SPACECRAFT NOMINAL ENCOUNTER SEQUENCE

ITEM	DATE	TIME	EVENT
1	14 July	15:53/E	CC&S MT-7 event received
2	14 July	17:53/E	DC-24 transmitted (approx.)
3	14 July	18:17/E	Scan prepositioned seen at Earth (approx.)
4	14 July	19:34/E	Goldstone rise
5	14 July	20:53/E	Johannesburg set
6	14 July	23:50/E	Approx. Wide Angle Acquisition (WAA) switch to Data Mode 3
7	15 July	00:02/E	Switch to Data Mode 3 seen at Earth. (approx.)
8	15 July	00:13/E	DC-16 transmitted
9	15 July	00:20/S	Narrow Angle Acquisition (NAA) at spacecraft
10	15 July	00:25/S	DC-16 arrives at spacecraft
11	15 July	00:32/E	NAA observed at Earth
12	15 July	00:38/E	DC-26 transmitted (DC-16 +25M)
13	15 July	00:39/E	DC-2 transmitted
14	15 July	00:45/S	Television recording sequence complete (NAA +25M)
15	15 July	00:50/S	All science and 400-cps single-phase inverter off
16	15 July	00:51/S	Cruise science on
17	15 July	01:02/S	Closest approach
18	15 July	01:35/E	Tidbinbilla rise
19	15 July	02:12/S	Spacecraft enters occultation region
20	15 July	02:24/E	Loss of RF signal at Earth
21	15 July	03:05/S	Spacecraft exits occultation region
22	15 July	03:17/E	RF signal observed at Earth
23	15 July	05:13/E	CC&S MT-8 event received
24	15 July	06:21/E	Goldstone set
25	15 July	09:30/E	Johannesburg rise
26	15 July	11:41/S	CC&S MT-9

(This table continued on next page.)

TABLE I-I. (CONT'D)

ITEM	DATA	TIME	EVENT
27	15 July	11:53/E	CC&S MT-9 and CY-1 No. 83 (initiate tape playback)
28	15 July	12:41/S	Start of Mode 4 data (Picture No. 1)
29	15 July	12:48/E	Tidbinbilla set
30	15 July	12:53/E	Start of Mode 4 data (Picture No. 1)
31	15 July	19:32/E	Goldstone rise
32	15 July	20:51/E	Johannesburg set
33	15 July	21:28/E	End of first picture
34	15 July	23:28/E	Start of second picture

D. OPERATIONAL ORGANIZATION

The organizational structure established to ensure the successful execution of the encounter and postencounter portion of the Mariner Mars '64 Mission is shown in Figure I-3. Primary mission responsibilities are also shown.

The cognizant personnel of the SFO System are:

1) Mission Director (Project Manager) - D. Schneiderman

2) SFO Systems Manager - T. S. Bilbo

3) Spacecraft Systems Manager - J. R. Casani

4) DSN Manager - N. A. Renzetti

5) SFO Director - D. W. Douglas

6) SPAC Director - A. G. Conrad

7) FPAC Director - N. R. Haynes

8) SSAC Director - R. K. Sloan

9) Data Processing Project Engineer - F. G. Curl

10) SFOF Operations Chief - P. J. Rygh

    a) SFOF Project Engineer - F. J. Walker

    b) Communications Project Engineer - R. McAvoy

11) DSIF Operations Chief - R. K. Mallis

    a) DSIF Operations Project Engineer - W. L. Brown

    b) DSIF Equipment Project Engineer - P. Parsons

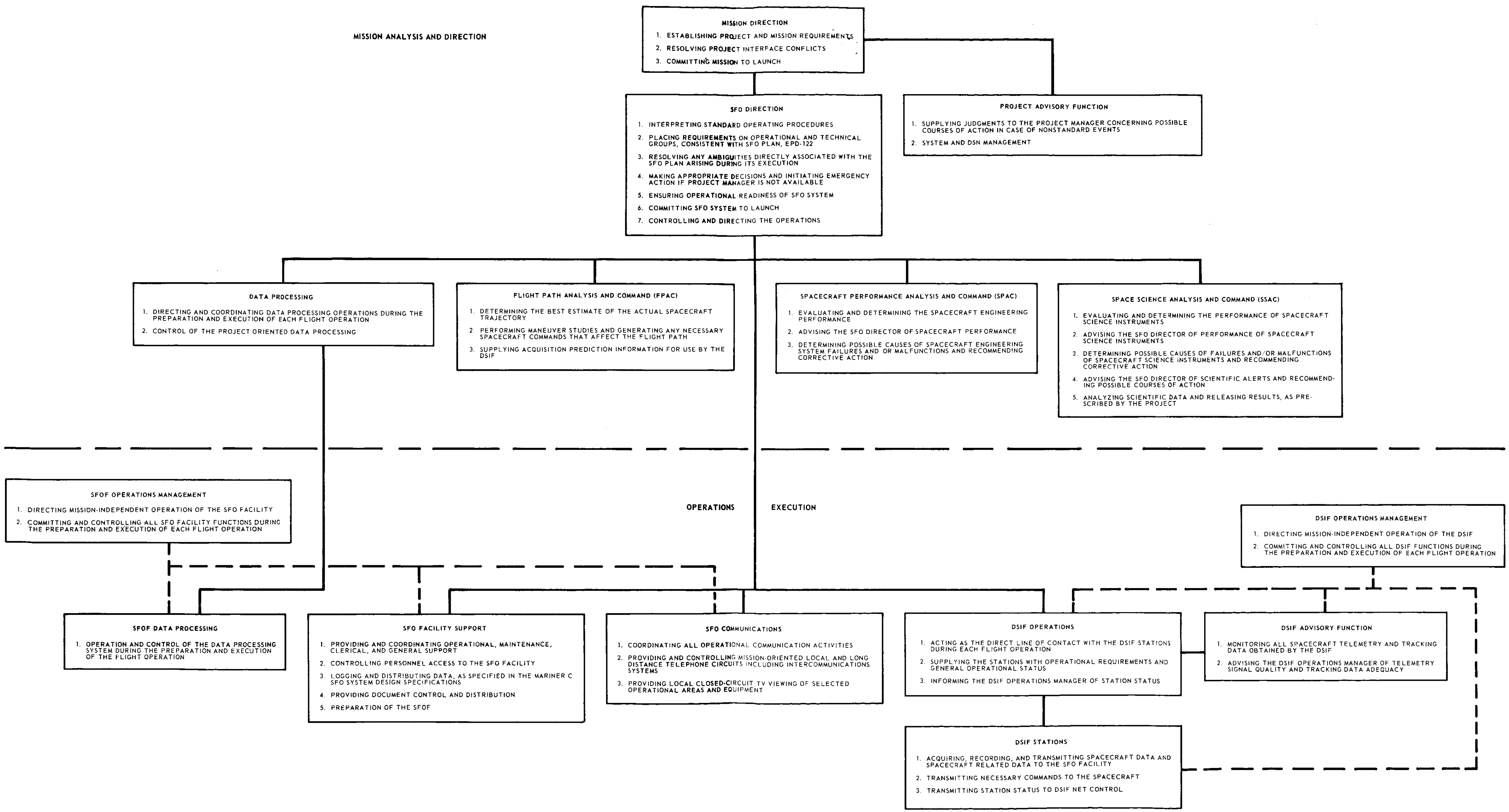


FIGURE I-3. SPACE FLIGHT OPERATIONS ORGANIZATION, MARINER MARS '64 MISSION

SECTION II

OPERATIONAL FACILITIES

THIS SECTION NOT AVAILABLE

AT THE TIME OF PUBLICATION.

SECTION III

DATA FLOW AND PROCESSING

A. GENERAL

This section depicts the data flow paths to, from, and within the facilities that will support the Mariner Mars '64 Mission. The DSN facilities referred to are the Deep Space Instrumentation Facility (DSIF) and the Space Flight Operations Facility (SFOF). Also discussed in this section are data flow, raw data flow, the Data Processing System (DPS), and data processing hardware, configurations, and controls. The mode of data processing used at any given time is primarily dictated by the Standard Sequence of Events, Table V-I.

The nature of the space flight operation is such that real time data flow is of prime concern. Control of this flow and of data processing is necessary so that the proper data is received and processed at the proper intervals. The Mariner Mars '64 operation is concerned with real time and nonreal time data.

1. Real Time Data

This is data received in real or near-real time via hardline or radio communication link and entered automatically in the DPS. The data is operated upon by the processing system and displayed on-line in the user areas as rapidly as operational priorities and user programs permit. Data is classified as real time if it is transmitted via microwave, phone line, or teletype within five minutes (in the case of Goldstone) or ten minutes (in the case of other DSIF stations) from time of receipt at the DSIF station. If buffered in the link (including the DPS) for more than five but less than thirty minutes, it is classified as near-real time.

2. Nonreal Time Data

This is data received by the DPS either in the form of magnetic tape recordings or of delayed transmissions from a communications link (more than thirty minutes after receipt of data at the DSIF station). Its main characteristic is that the processing is delayed and the results are prepared off-line from the DPS. There is no necessity for a feedback path from the analysis area nor for very rapid throughput and display. Data from the sources is entered, directly or by magnetic tape, in either of the two available 7044s which will perform the same input functions performed on real time data but will record the collected and formatted input data on magnetic tape only. These tapes will then be batch-processed on the 7094 at prescheduled intervals and magnetic tapes will be generated to drive the off-line display devices.

The mathematical processing of incoming data constitutes the major effort in data handling in the SFOF. The type of incoming data (whether telemetry or tracking), as well as the ultimate users, determine the type of computation required. The principal groups using spacecraft or spacecraft-related data and the type of data they use are listed below. It is the responsibility of these groups to interpret, analyze, and evaluate the type of data of which they are cognizant.

GROUP	TYPE OF DATA
Spacecraft Performance Analysis and Command	Engineering telemetry
Space Science Analysis and Command	Science telemetry
Flight Path Analysis and Command	Tracking data
DSIF Net Control	DSIF status
Mission and Operations Control	Summary of all data and status

The complete data flow to, within, and from the SFOF is shown in Figures III-1, III-2, and III-3. The flow from the SFOF comprises acquisition and tracking information and commands for the DSIF, general status information, and spacecraft performance data. The flow of scientific data from the SFOF is described in Section VII of this document. All DSIF flight data will be forwarded within 48 hours to:

SFOF Document Control
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California, 91003
U. S. A.

The incoming data circuits will be routed through the Communications Center to the 7288 for processing by the 7044. This data will also be available on teletype (TTY) machines and closed-circuit TV (CCTV) in the user areas.

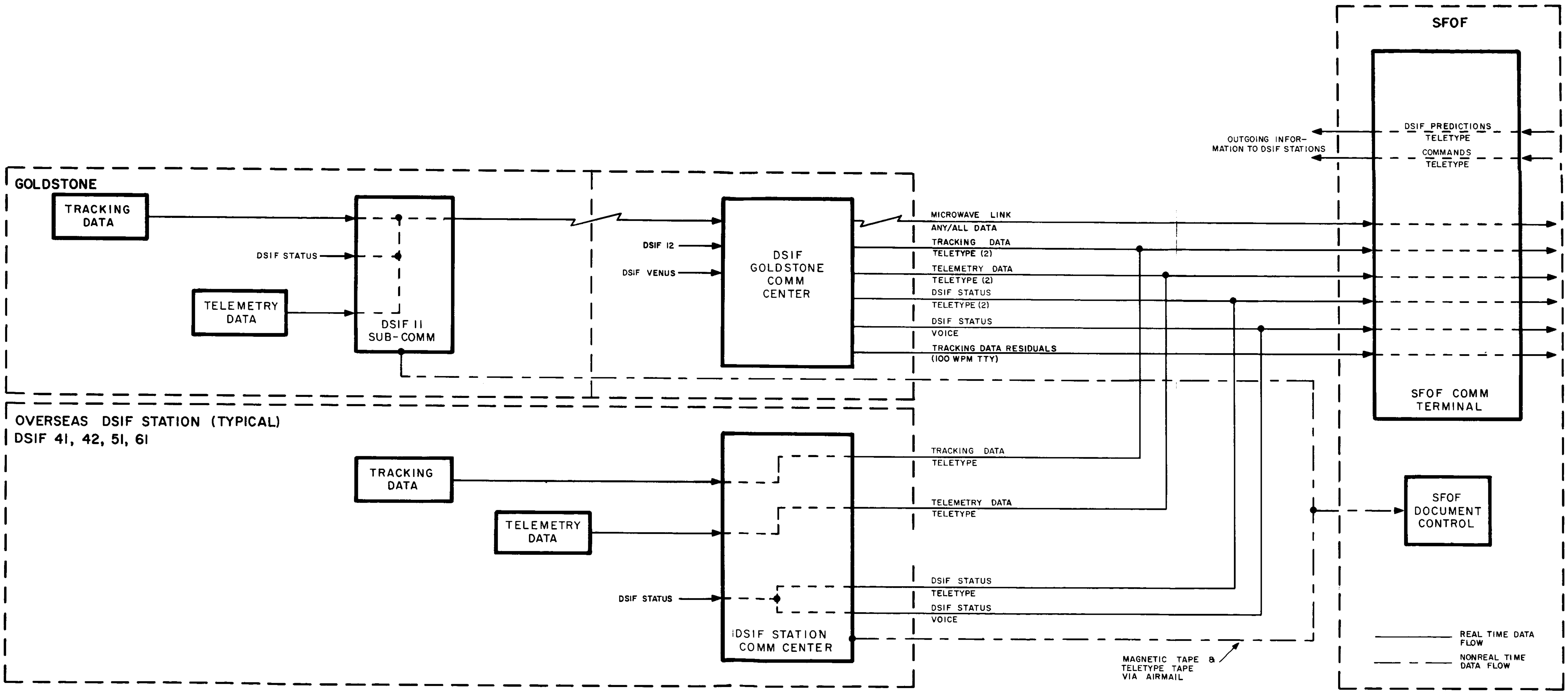


FIGURE III-1. DATA FLOW FROM THE DSIF TO THE SFOF

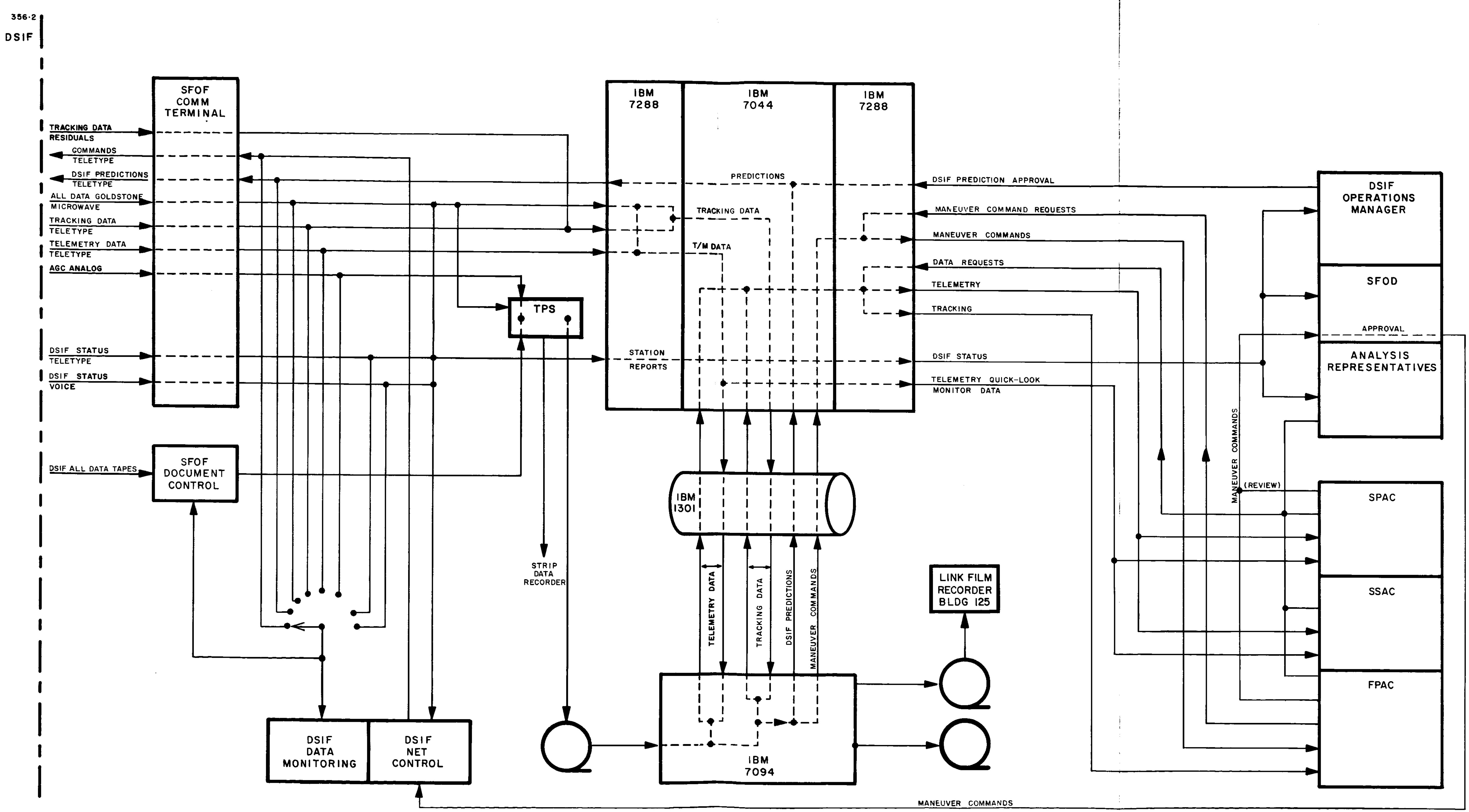


FIGURE III-2. COMPLETE DATA FLOW WITHIN THE SPACE FLIGHT OPERATIONS FACILITY

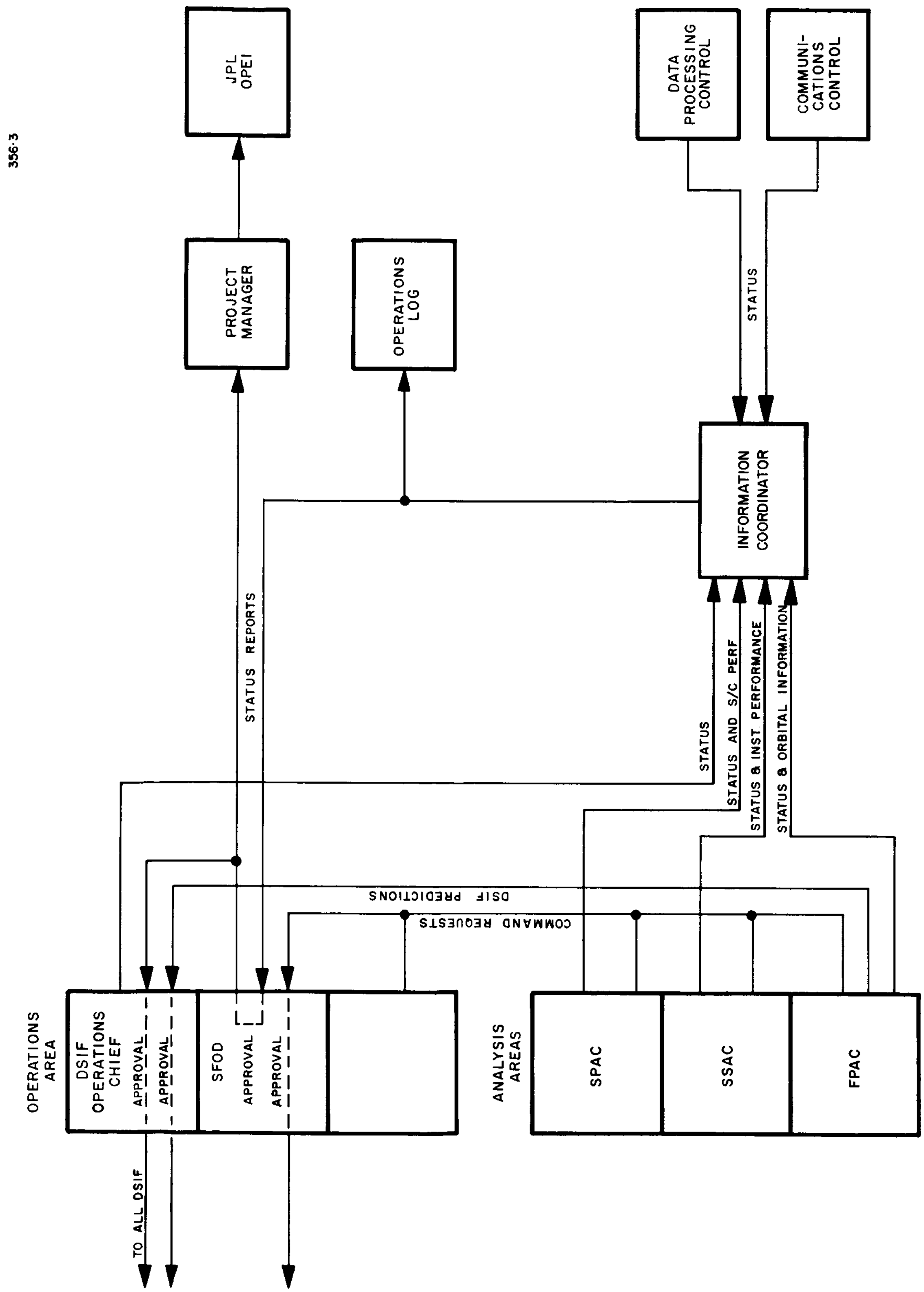


FIGURE III-3. COMPLETE DATA FLOW FROM THE SPACE FLIGHT OPERATIONS FACILITY

SECTION IV

SPACECRAFT COMMANDS

A. GENERAL

It is the purpose of this section of the SFOP for Encounter to describe the operational aspects of the Mariner IV command system and to state general control procedures for its use.

There are two major categories of commands: 1) ground and 2) on-board.

The ground commands are transmitted from the ground to the spacecraft for corrective action in event of nonstandard space flight operations or as a backup to the on-board logic.

The on-board command sequence and timing are issued by the Central Computer and Sequencer (CC&S) which is preset prior to launch. These on-board spacecraft commands are listed in the Standard Sequence of Events, Section V, as events occurring on the spacecraft.

B. COMMAND PHILOSOPHY AND CONTROL

The following items constitute the basic ground rules of philosophy and control on the use of ground commands:

1) Any command or commands deemed necessary for corrective action or for achieving standard space flight operation must be approved by the Space Flight Operations Director. Upon concurrence of the Project Manager, the commands will be transmitted to the DSIF station for execution.

2) Command requests will be made only by the technical and operations teams within the SFOF using approved command decision procedures.

3) The procedure by which commands are transmitted from the SFOF to the DSIF is outlined in Paragraph G of this section. The DSIF procedure for transmitting commands to the spacecraft is found in the Tracking Instruction Manual (TIM), EPD-167.

C. GROUND COMMANDS

The ground commands transmitted from the DSIF stations are divided into two types:

1) Direct (execute) Commands (DC) which initiate instant action on-board the spacecraft

2) Quantitative (information) Commands (QC) which are stored in the CC&S for the purpose of timing the length of maneuver events

A standard ground command word comprises 26 serial bits, as shown in Table IV-I. The first three bits act as the command framing (or start) bits. The remaining bits give the command address, and information to the CC&S in the case of Quantitative Commands. The CC&S information comprises the last 18 bits of the command word. The first five of these bits contain the address of the register to be modified. The sixth bit is adjusted, in QCs, to give odd bit parity for the 18-bit CC&S word. The next 11 bits contain the time value that is to be stored in the specified register. The last bit, bit 18, is the polarity bit. The presence of a "one" in this position calls for a positive turn.

These commands are stored by the CC&S to control the maneuver (post-encounter). Specifically, they are the following:

1)	QC1-1	Pitch Turn Duration	
		Maximum value	1319 seconds
		Resolution	1 second
2)	QC1-2	Roll Turn Duration	
		Maximum value	1319 seconds
		Resolution	1 second
3)	QC1-3	Motor Burn Time	
		Maximum value	102.36 seconds
		Resolution	0.04 to 0.08 seconds

The command address completely identifies which ground command (whether Quantitative or Direct) has been sent. Although the CC&S information block contains no information in the case of Direct Commands, the bits are transmitted as binary "zeros" to maintain compatibility with the standard word format. All ground command words are transmitted at the rate of one bit per second. The command message is formatted on a five-level teletype paper tape as shown in Figure IV-1. A punched hole corresponds to a "one" and no punch corresponds to a "zero".

D. SPACECRAFT COMMAND SUBSYSTEM

The Spacecraft Command Subsystem, consisting of a command detector and a command decoder, determines the presence of commands at the output of the spacecraft radio receiver, identifies the received commands, and routes the commands to the designated spacecraft subsystem.

There are two modes of operation: one for Direct Commands (DC) resulting in the single momentary closure of a solid-state switch, and one for Quantitative Commands (QC) where readout switches relay the information to the CC&S. Control of these modes is internal to the command decoder on board the spacecraft and is totally dependent upon the command word received.

TABLE IV-I. GROUND COMMAND WORD STRUCTURE

MARINER C COMMAND WORD FORMAT

COMMAND BIT NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
COMMAND BIT IDENTIFICATION	COMMAND DECODER START			COMMAND ADDRESS						ADDRESS PARITY SEE NOTE NO.1		BITS 12-26 HAVE NO SIGNIFICANCE IN DC'S. IN QC'S THEY FORM PART OF THE CC&S COMMAND. REFER TO QUANTITIVE COMMAND FORMAT.														
COMMAND BIT VALUE	1	1	0	VARIABLE								ZERO FOR DC'S; VARIABLE FOR QC'S														

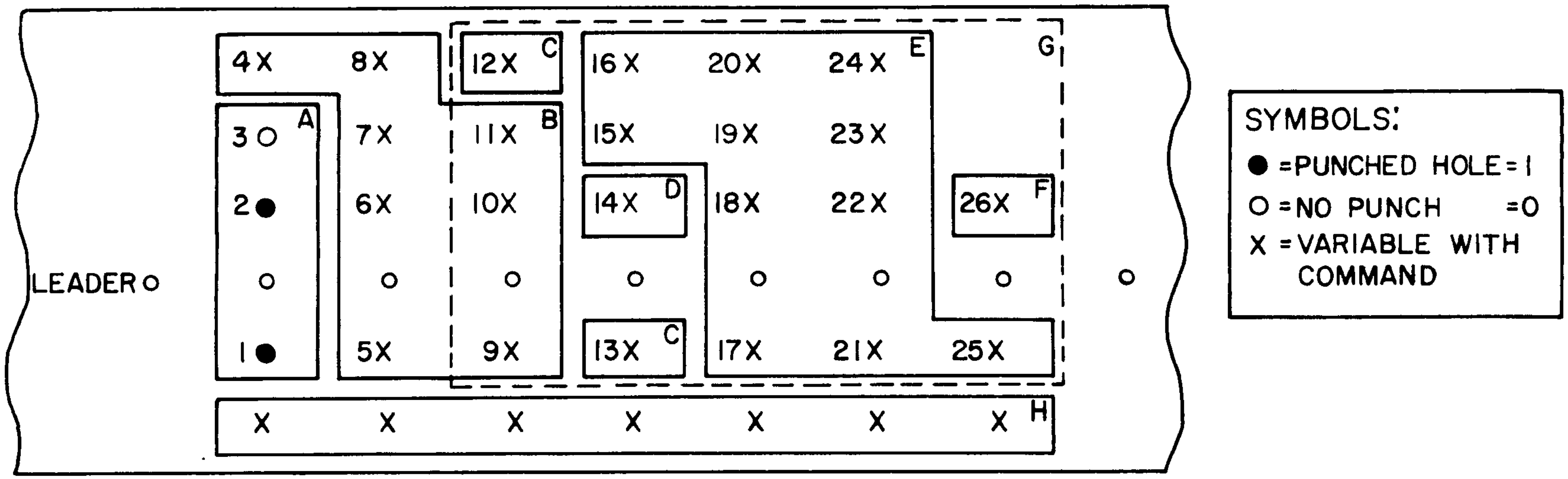
QUANTITATIVE COMMAND (QC) FORMAT

	COMMAND BIT NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
	CC&S COMMAND BIT NO.									1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	CC&S COMMAND BIT IDENTIFICATION									CC&S ADDRESS: SEE NOTE NO.2			CC&S ADDRESS: REGISTER SELECTOR		ODD PARITY	TIME VALUE (SEE NOTE NO. 5)											POLARITY
QC COMMAND BIT VALUES	PITCH TURN	1	1	0	0	1	1	0	0	0	1	1	1	0	SEE NOTE NO. 3	VARIABLE											SEE NOTE NO 4
	ROLL TURN	1	1	0	0	1	1	0	0	0	0	0	0	1		VARIABLE											
	MOTOR BURN	1	1	0	0	1	1	0	0	0	1	0	1	1		VARIABLE											

NOTES:

1. COMMAND BIT NOS. 10 AND 11 ARE ADJUSTED TO ENSURE AGAINST SINGLE BIT ERRORS CAUSING AN INCORRECT COMMAND WORD OUTPUT.
2. COMMAND BIT NOS. 9-11 (CC&S COMMAND BIT NOS. 1-3) ARE NOT USED QUANTITATIVELY BY CC&S BUT ARE USED TO REMAIN COMPATIBLE WITH PREVIOUSLY DESIGNED HARDWARE (MR 62).
3. COMMAND BIT NO. 14 (CC&S COMMAND BIT NO. 6) IS ADJUSTED IN QC'S TO GIVE AN ODD NUMBER OF "ONE" BITS IN COMMAND BIT NOS. 9-26 (CC&S BIT NOS. 1-18).
4. COMMAND BIT NO. 26 (CC&S COMMAND BIT NO. 18) MUST BE A "ONE" TO PRODUCE A CW (POSITIVE) SPACECRAFT ROTATION ABOUT THE SPECIFIED SPACECRAFT AXIS. A "ZERO" IN THIS BIT POSITION WILL RESULT IN A CCW (NEGATIVE) SPACECRAFT ROTATION ABOUT THE SPECIFIED SPACECRAFT AXIS. POLARITY BIT FOR MOTOR BURN COMMAND IS ALWAYS "ONE".
5. COMMAND BIT NOS. 15-25 (CC&S COMMAND BIT NOS. 7-17) ARE A PSEUDO-BINARY CODE REPRESENTATION OF THE TURN OR MOTOR BURN DURATION.

MARINER C RWV COMMAND MESSAGE TAPE FORMAT



A- COMMAND DECODER START BITS (ALL COMMANDS)

B- COMMAND ADDRESS AND ADDRESS PARITY (ALL COMMANDS)

C- CC&S REGISTER SELECTOR BITS (QC'S ONLY)

D- ODD PARITY BIT FOR "G" (QC'S ONLY)

E- CC&S TIME VALUE BITS (QC'S ONLY)

F- CC&S POLARITY BIT (QC'S ONLY)

G- 18 CC&S BITS TO BE CHECKED BY "D"

H- TELETYPE PARITY BITS (ALL COMMANDS); PROVIDES ODD PARITY FOR COLUMNS

NOTES:

1) BITS 11-26 ARE ZERO FOR DC'S
2) PUNCHED HOLE IS EQUIVALENT TO "ONE"
NO PUNCH IS EQUIVALENT TO "ZERO"

FIGURE IV-1. RWV COMMAND MESSAGE TAPE FORMAT

The spacecraft will have 14 Direct Commands which can be utilized for Encounter. There is one Quantitative Command with three addresses and four Direct Commands for performing a second maneuver during the postencounter period. These commands, their functions, and binary and octal formats, are listed in Table IV-II. In addition, the Mariner C polarity convention is shown in Figure IV-2 for further clarification.

E. GROUND COMMAND SUBSYSTEM

The Ground Command Subsystem, which is capable of reading, writing, and verifying (RWV) commands, is a self-checking command processor. It is designed to accept incoming command messages, verify through redundancy the validity of the messages, convert the command into a form suitable for transmission to the spacecraft, read the transmitted signal, verify the signal's validity, and write (punch tape) the transmitted command.

The command message is prepared in the SFOF and transmitted to the appropriate DSIF station via voice and teletype. A prepunched tape or a punched tape received via teletype line at the DSIF station is fed into the RWV subsystem's tape reader, compared, checked, and displayed. For transmission to the spacecraft, the modulator output is connected to the RF transmitter driver. RF energy is fed to the spacecraft receiver and a sample of the transmitted signal is returned to the Ground Command Subsystem by means of a dipole mounted on the DSIF antenna. The returning signal is then checked and displayed as before. If an error is detected, either in the command or in the logic and control circuitry, command transmission will be inhibited. A new tape is punched by the RWV as a permanent record of the transmission.

F. CENTRAL COMPUTER AND SEQUENCER (CC&S)

The CC&S supplies the on-board timing, sequencing, and computing services for the subsystems on the spacecraft. The CC&S contains the preset sequences which include: 1) a launch sequence based on launch time which controls spacecraft events from launch until the cruise mode is established, 2) a maneuver sequence which controls the spacecraft events necessary to perform a trajectory correction maneuver, and 3) a master timer sequence based on nominal encounter time which controls all spacecraft events during cruise, encounter, and postencounter. A frequency reference, accurate to 0.01%, controls the timing in all sequences. The predetermined events in the CC&S are fixed prior to launch and cannot be changed after launch.

G. COMMAND INSTRUCTIONS

1. Communications Priority

The primary communications mode for command messages will be teletype. All command messages and verifications described in this section will be transmitted by teletype with the exception of the voice command, "TRANSMIT DC-13". The backup communication mode for command messages will be voice. Command messages transmitted by voice are in the same format as the teletype messages and will be confirmed by teletype message as soon as possible.

TABLE IV-II. MARINER IV DIRECT AND QUANTITATIVE COMMANDS FOR ENCOUNTER

COMMAND; EVENT	BINARY VALUE; OCTAL VALUE	TIME OF USE	CONDITION FOR USE	CONSTRAINTS FOR USE	REMARKS
DC-1 Command T/M Mode 1	110 000 011 00 00 000 000 000 000 0 6030000000	During Postencounter T/M Mode 4	Actual or suspected malfunction of the S/C	The attainment of TV data could not be accomplished without the use of DC-1.	Transmittal of this command at this time will place the spacecraft in T/M Mode 1 with cruise science off and tape electronics on.
			To monitor engineering telemetry should an emergency power situation exist.	The attainment of TV data could not be accomplished without the use of DC-1.	Transmittal of this command at this time will place the spacecraft in T/M Mode 1 with cruise science off and tape electronics on.
DC-2 Command T/M Mode 2 (Turn on Cruise Science	110 011 011 10 00 000 000 000 000 0 6332000000	During Encounter Phase	D/E not switched to T/M Mode 2 at completion of picture recording. (D/E in T/M Mode 3.)		The command must be transmitted without the knowledge of command detector lock condition.
		After MT-8	Following DC-26 used to backup MT-8.		This command should arrive at the spacecraft during the science part of the Mode 2 format to reduce D/E deck resets.
		Following Playback of Recorded Data	To obtain additional Cruise Science data after recorded data has been successfully transmitted.		
DC-3 Command T/M Mode 3	110 101 011 00 00 000 000 000 000 0 6530000000	After Nominal Wide-Angle Acquisition Time	D/E is not switched to T/M Mode 3 at nominal wide-angle acquisition time.		This command should arrive at the S/C during the science part of the Mode 2 format to reduce D/E deck resets.
		After 5 1/2 hours before closest approach.	Necessary to evaluate the encounter science before the record phase.	This must have a higher priority than the engineering data which it will replace.	This command should arrive at the S/C during the Science part of the Mode 2 format to reduce D/E deck resets.

(This table continued on next page.)

TABLE IV-II. (CONT'D)

COMMAND; EVENT	BINARY VALUE; OCTAL VALUE	TIME OF USE	CONDITION FOR USE	CONSTRAINTS FOR USE	REMARKS
DC-4 Command T/M Mode 4 (Switch Cruise Science Off)	110 011 101 00 00 000 000 000 000 0 6350000000	After E+13 1/3 hours	D/E is not switched to T/M Mode 4 by MT-9.		
DC-15 Canopus Gate Inhibit Override	110 001 100 00 00 000 000 000 000 0 6140000000	During Roll Search	Brightness gate fails or is incorrect for Canopus intensity.		Disconnects search signal from switching amplifier input, replacing it with the Canopus sensor output. Gyros will be turned off 200 seconds following reception.
		During Cruise Phase	Canopus Tracker is seeing bright objects which cause roll search signal when they pass in front of the sensor.		This removes the brightness gates and will allow the S/C to track a slow moving bright object off of Canopus if one comes in front of the sensor. The gyro will not come on and the receiver will remain on the high-gain antenna, if it is placed there.
DC-16 Narrow-Angle Acquisition	110 101 000 00 000 000 000 000 0 6500000000	Encounter Phase	Backup for science "Planet in View" signals to DAS from Narrow Angle Mars Gate or TV. Wide angle acquisition has occurred and scan platform is tracking planet.	To be sent such that it arrives at S/C shortly after nominal time of NAA by NAMG.	Will inhibit scan platform motion and initiate TV recording sequence. If the Scan Subsystem is still searching the command should arrive at the S/C at a time to position the TV at the optimum pointing angle after the normal NAA.
DC-18 Gyros on Inertial Control. Roll Positive Increment.	110 100 100 00 00 000 000 000 000 0 6440000000	Any time when Sun Acquired.	Failure or suspect possible failure in normal roll channel control circuitry - in the near Mars vicinity. Control of roll attitude by radio command required.		First DC-18 places roll gyro in position mode. Subsequent use of MC-18 and DC-21 permit roll attitude control.

(This table continued on next page.)

TABLE IV-II. (CONT'D)

COMMAND; EVENT	BINARY VALUE; OCTAL VALUE	TIME OF USE	CONDITION FOR USE	CONSTRAINTS FOR USE	REMARKS
DC-18 (Cont'd)					Initial DC-18 results in +2 1/4° roll if gyros are on at the time of command; no turn results when gyros are off at the time of command.
		After DC-18.	Desire roll attitude required additional +2 1/4° S/C rotation.	Previous DC-18 must have been received.	S/C attitude maintains new position subject to drift rate of gyro.
		Encounter Phase	Failure of scan platform requires reorientation of S/C so planet is in view of TV.		Commands may have to be sent to S/C without knowledge of command detector lock condition.
DC-19 Gyros off; Normal Control	110 100 010 00 00 000 000 000 000 0 6420000000	After DC-15, 18 or 20	Conditions resulting from all previous DC-15, 18 and 20 are no longer needed		
			Want the gyros to come on if the Canopus Tracker loses the Star Canopus.		If the encounter is going to be performed while receiving on the high-gain and Canopus Sensor. This will allow the gyros on function to switch the receiver to the low-gain antenna if the Star Canopus is lost.
					Commands may have to be sent to S/C without knowledge of command detector lock condition.
					Telemetry may be lost and attitude of S/C may not be known accurately.
					The 100 kw transmitter will be required to execute this sequence.

(This table continued on next page.)

TABLE IV-II. (CONT'D)

COMMAND; EVENT	BINARY VALUE; OCTAL VALUE	TIME OF USE	CONDITION FOR USE	CONSTRAINTS FOR USE	REMARKS
DC-21 Roll Override. Roll Increment Negative	110 111 010 00 00 000 000 000 000 0 6720000000	After Canopus Sensor Turn On	Undesirable star acquired.		Turn on gyros and commands S/C negative turn rate.
		After DC-18 Transmission.	Desired roll attitude requires additional -2 1/4° S/C rotation.	DC-18 required previously to get this effect.	
DC-22 Track Change Command	110 111 001 00 00 000 000 000 000 0 6710000000	During VSS Data Playback (T/M Mode 4).	Tape electronics does not switch tracks during playback.		Tape electronics switching tracks an even number of times during playback will appear the same as not switching.
DC-24 Inhibit Scan Search	110 100 001 00 00 000 000 000 000 0 6410000000	During Encounter Phase.	Scan search and/or track function not working properly.	Command transmission to be timed to stop scan platform in a position allowing view of the planet by TV.	
			Command transmission cannot be timed to stop scan platform in a position allowing view of the planet by TV.	See Encounter Phase Condition, Constraint, and Remarks for DC-18.	
			Want to optimize the TV coverage by prepositioning the scan platform.	Command transmission to be timed to stop the scan platform in the optimum position for TV coverage of the planet.	This command should be sent to arrive before the first possible WAA (5 1/4 hours before closest approach).
DC-25 Turn on Planet Science Unlatch Cover: A. Switch Off Cruise Science B. Switch Battery Charger Off	110 010 010 00 00 000 000 000 000 0 6200000000	After time of MT-7.	MT-7 doesn't occur or fails to cause these functions to occur: a) Turn on planet science b) Turn on tape recorder electronics c) Turn cruise science on, if not on previously.		Command to be sent as soon as possible after condition noted. Science cover has been removed and the battery changer has been turned off.
		Before time of MT-7.	Wish to evaluate encounter science more than 8 1/2 hours before start of record sequence.		

(This table continued on next page.)

TABLE IV-II. (CONT'D)

COMMAND; EVENT	BINARY VALUE; OCTAL VALUE	TIME OF USE	CONDITION FOR USE	CONSTRAINTS FOR USE	REMARKS
DC-26 Turn Off Planet Science A. Switch Off Cruise Science	110 011 110 00 00 000 000 000 000 0 6360000000	After time of MT-8.	MT-8 does not occur or fails to turn off encounter science.		Use at this time requires DC-2 to turn on cruise science.
B. Switch Battery Charger Off		Cruise Phase	Turn off battery charger and cruise science required because of emergency power condition.		
		Battery fully charged.			Permits battery boost mode should load sharing occur with gyros off. DC-2 required to turn on cruise science.
DC-28 Turn on Battery Charger	110 110 110 10 00 000 000 000 000 0 6662000000	Cruise and Post-encounter sequences	Require battery charger turn-on.	Power must be available to support this load.	
Turn off Tape Electronics		Cruise	Tape electronics turned on prior to encounter.		This condition must be rectified such that the tape recorder count two and stop circuitry can be reset. If this circuitry is not reset it will not be possible to record data at the planet. This command should be sent after the end of tape to get the maximum recorded data. If received by the tape recorder while the tape is moving in the record mode the tape will continue to move through the recorder while the 400 cps 1 Ø power is on.

(This table continued on next page.)

TABLE IV-II. (CONT'D)

COMMAND EVENT	BINARY VALUE: OCTAL VALUE	TIME OF USE	CONDITION FOR USE	CONSTRAINTS FOR USE	REMARKS
DC-14 Remove Maneuver Inhibit. Remove Propulsion Inhibit.	110 010 100 00 00 000 000 000 000 0 6240000000	1. Prior to Start of Maneuver Sequence (DC-27)	1. Midcourse maneuver is necessary; DC-13 not previously utilized.		1. This command is part of the maneuver command sequence. It is intended to ensure proper state of pyro relays.
		2. Five (5) Minutes after DC-27	1. Midcourse maneuver is necessary; DC-13 previously utilized to effect initiation of Canopus acquisition sequence.		1. For this condition the command not only ensures proper state of pyro relays but also restores A/C signal power to CC&S relay contacts for subsequent maneuver sequence switching; thus permitting maneuver.
		3. Following DC-13 Used to Inhibit Midcourse Maneuver	1. Midcourse maneuver to be reattempted.	1. Send after M +199 min. of initial maneuver sequence, as part of the maneuver command sequence.	1. Retransmission of QCs must be delayed until after M +199 min. to permit acceptance by CC&S.
DC-23 Arm Second Propulsion Maneuver	110 001 111 00 00 000 000 000 000 0 6170000000	1. Before Second Midcourse Maneuver	1. A second midcourse maneuver is required.		1. This command is part of the second maneuver command sequence. This ensures proper state of pyro relays.
DC-27 Initiate Midcourse Maneuver	110 100 111 00 00 000 000 000 000 0 6470000000	1. At Initiation of Midcourse Sequence	1. Initiation of standard midcourse sequence required.	1. Must be preceded by QC1-1, 1-2, 1-3, DC-29 or DC-23, and DC-14 in standard maneuver sequence	
			2. Initiation of modified midcourse sequence required.	1. Must be preceded by QC1-1, 1-2, 1-3, DC-29 or DC-23, in modified maneuver sequences.	1. DC-14 to follow DC-27 in modified maneuver sequences (See DC-13 Condition at "Following Time of L -3" and DC-14 Condition at "Five Minutes after DC-27".
QC1-1 Pitch Turn	110 011 000 11 10 zxx xxx xxx xxx y 63032xxxxy				
QC1-2 Roll Turn	110 011 000 00 01 zxx xxx xxx xxx y 63001xxxxy				
QC-13 Motor Burn	110 011 000 10 11 zxx xxx xxx xxx y 63023xxxxy				

(This table continued on next page.)

TABLE IV-II. (CONT'D)

DC-13 Maneuver Command Inhibit. Turn on Solar Vanes, Canopus Sensor, and Attitude Control. Inhibit Prop. Command	110 010 111 00 00 000 000 000 000 0 6270000000	1. Before M +102 Min. in Midcourse Sequence	1. Recognized error in midcourse turn(s) or failure in midcourse-related equipment	1. The observed turn must cause predetermined criteria to be violated.	
				2. Must not arrive at S/C after start of motor burn.	1. The command interrupts signal power between A/C and CC&S and interrupts signal between CC&S and pyro.
		2. After M +110 Min. in Midcourse Sequence	1. D/E not switched to Data Mode 2 at M +110 min.		1. See DC-2, condition 1.

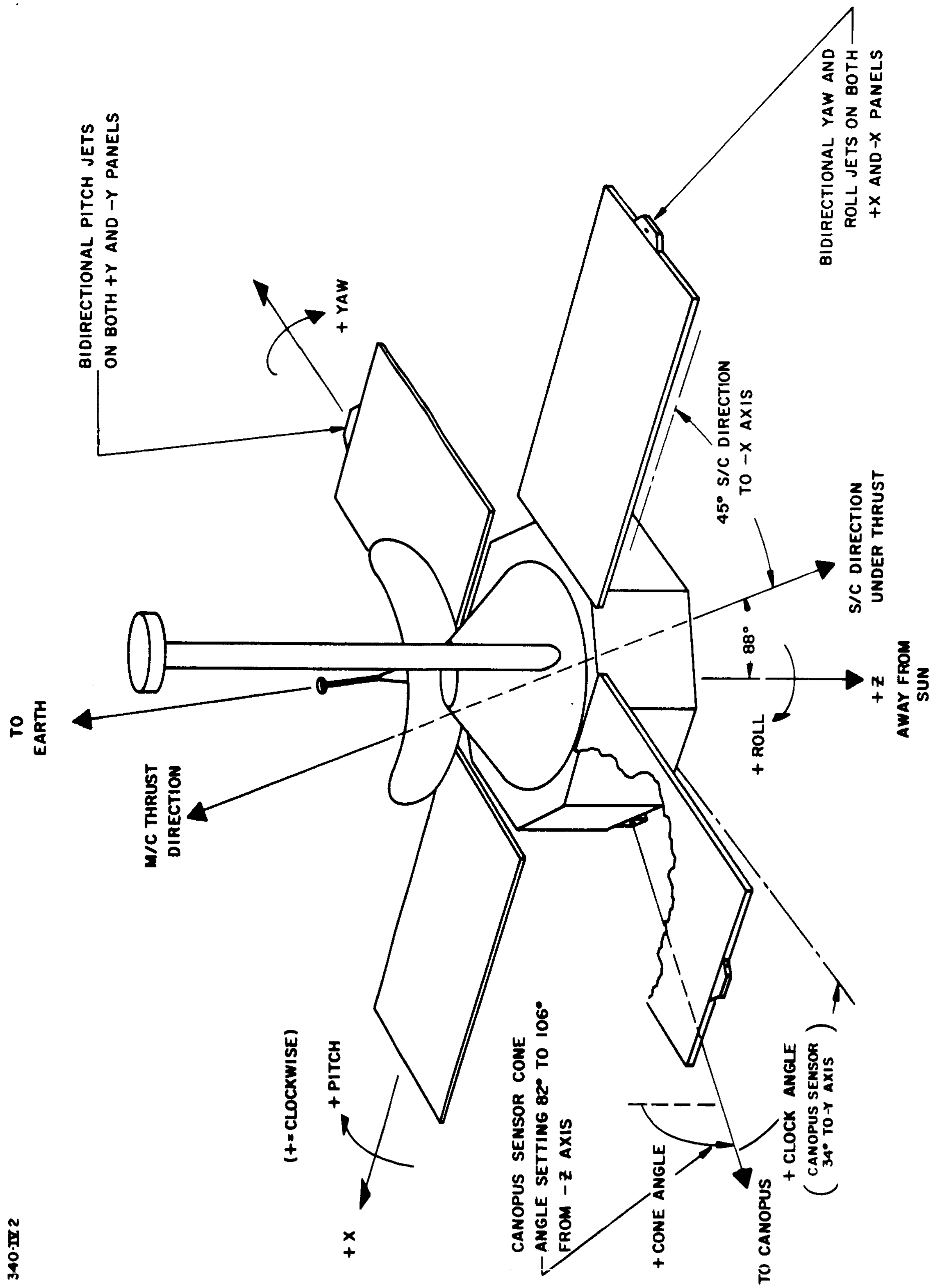


FIGURE IV-2. MARINER C POLARITY CONVENTION

2. Code Words

Each DSIF station having command capability will be provided with an appropriate list of four-letter code words to be used during the Mariner '64 Mission. The code words will appear before the text of the command message and are used to assure that the message is originating in DSIF Net Control. Code words will be assigned sequentially by the DSIF Operations Manager on all messages involving the transmission of commands. No individual code word will be used more than once for any given station. Command messages, in which only the code word is "garbled", will not be repeated by the station if the Station Manager can recognize the expected code word.

3. Frequency

An up-link frequency designation shall be used as a method of command-spacecraft identification. This frequency designator will follow and be in line with the code word which precedes the command message text. The frequency designator shall be identified by the first digit of the up-link frequency to the left of the decimal and the first digit to the right of the decimal. (For example, if the up-link frequency was 2116.381944, the designator indicated on the command message would be 63).

The up-link frequency designator will be assigned by the DSIF Operations Manager and verified by the SFO Director for all command messages.

4. Channel

The DSIF channel assignment for the ground-spacecraft operational frequency will be used on all command messages as a further method of command-spacecraft identification. The channel designator will follow and be in line with the up-link frequency designator.

The channel designator will be assigned by the DSIF Operations Manager and approved by the SFO Director for all command messages. Table IV-III identifies the relationship between the DSIF channel, the spacecraft serial number, ground transmitter frequency, and the ground receiver.

5. Checking Command Transmission Readiness

Approximately 45 minutes prior to turning on command modulation, the command station and DSIF Net Control will go through the following sequence:

a. The command station shall request permission of DSIF Net Control to zero the spacecraft static phase error. Spacecraft AGC and ground transmitter frequency and power level shall be reported with the request.

b. DSIF Net Control will verify the spacecraft condition with the SPAC Telecommunications Advisor and grant permission to the command station to proceed with adjustment of static phase error.

TABLE IV-III. OPERATIONAL FREQUENCY ASSIGNMENT MARINER MARS '64

Spacecraft Serial Number	DSIF Channel	Ground Receiver (mcs)	Ground Transmitter (mcs)
MC-3	21	2297.592593	2115.699846

c. After adjusting the spacecraft static phase error, the command station shall report the spacecraft AGC and the ground transmitter frequency and shall request permission by DSIF Net Control to turn on command modulation.

d. DSIF Net Control will verify with the SPAC Telecommunications Advisor that the spacecraft is in an acceptable condition for command modulation and that no critical events are expected, then grant permission for turning on command modulation. (It is possible to lose RF lock when modulation is turned on.)

e. Subsequent to turning on command modulation, the command station shall report:

1) Modulation on
2) Monitor receiver in lock
3) Monitor receiver AGC
4) Ground transmitter frequency
5) Ground receiver AGC
6) Spacecraft AGC
7) Ground transmitter power level

f. With the concurrence of the SPAC Telecommunications Advisor, the station will be instructed by DSIF Net Control to normalize their $8F_s$.

g. After the above procedures have been accomplished, the DSIF Net Control will reverify the spacecraft and ground conditions with the SPAC Telecommunications Advisor and will grant permission to the command station to transmit commands to the spacecraft.

6. Transmission of Commands by the DSIF to the Spacecraft

a. The command tape, either the prepunched Direct Command (DC) or the verified Quantitative Command (QC) tape, is fed into the Read, Write, Verify (RWV) system with the system set up for MANUAL INITIATION of the command transmission. (The Direct Commands are available at the DSIF station on prepunched tapes.) At the time specified in the command message, the command operator will initiate the command transmission. The system will begin its transmit cycle, which also includes a verify mode. If the RWV detects an error either in the command format or in the RWV circuitry (the RWV cannot detect an incorrect command), the command transmission will be inhibited. However, there is an emergency mode that will be used if it is desired or necessary to transmit a command without using the verify mode of the transmit cycle. When operating in this mode, the proper terminology to be used in reporting command transmission is "initiated" and "completed" rather than "initiated" and "verified".

b. The DC-26 command will be a voice command and will be time designated by the word IMMEDIATELY. All other commands will be time commands and follow Timed Sequence Instructions which have been sent to all DSIF stations.

c. The backup command (specified in the command message) will only be sent if an inhibit occurs in the transmission of the prime command or if the transmitting station does not receive a verification on Channel 115.

d. After successful command transmission, the DSIF Station Manager will notify DSIF Net Control, by voice and/or teletype, of the command transmitted and the initiate and verify or completion times (whichever is applicable). The Station Manager will also include this information and the time a verification is received from the spacecraft on Telemetry Channel 115/116 in the next tracking report.

H. COMMAND TRANSMISSION PROCEDURES

The success or failure of the Mariner Mars '64 Mission, which may be dependent on the prudent use of commands, requires careful planning prior to encounter. Caution in the execution of these commands during encounter must be exercised.

Consistent with this philosophy, the Quantitative Commands for the post-encounter maneuver after being thoroughly verified before their transmission from the DSIF, will be checked in real time through the spacecraft telemetry prior to execution by observing the CC&S event indications.

The format of the command messages, and the transmission and verification procedures follow.

1. Maneuver Commands (Postencounter)

a. Verification in the SFOF

The messages shown in Table IV-IV will be generated by the IBM 7094 in a teletype format and placed on the IBM 1301 disc. The message may be called up by the Flight Path Analysis Area (FPAA) I/O Console and will be sent out on a predetermined computer teletype circuit. This circuit will be looped to the Communications Center to an SFOF internal teletype circuit; its output will be in the FPAA on a TTY page printer

TABLE IV-IV. MANEUVER COMMAND MESSAGE FORMAT, POSTENCOUNTER MANEUVER

CODE F(X. X) C(YY)

MANEUVER COMMANDS MC-(X, Y), 2nd MANEUVER

	HHMM Z	HHMM Z	HHMM Z
QC ONE-ONE	63032 abcdp	63032 abcdp	63032 abcdp
QC ONE-TWO	63001 abcdp	63001 abcdp	63001 abcdp
QC ONE-THREE	63023 abcdp	63023 abcdp	63023 abcdp

TRANSMIT DC TWENTY-THREE (6170) AT

HHMM Z HHMM Z HHMM Z

TRANSMIT DC FOURTEEN (6240) AT

HHMM Z HHMM Z HHMM Z

PREPARE TO TRANSMIT DC TWENTY-SEVEN (6470) INITIATE MANEUVER AT

HHMM Z HHMM Z HHMM Z

PREPARE TO TRANSMIT DC THIRTEEN (6270) INHIBIT

MANEUVER BEFORE HHMM Z HHMM Z HHMM Z

BACKUP DC THIRTEEN BEFORE

HHMM Z HHMM Z HHMM Z

QC 1-1 QC 1-2 QC 1-3 FOLLOW IN ORDER IN CODE

THREE TIMES

XXXXXXX

XXXXXXX

XXXXXXX

YYYYYYY

YYYYYYY

YYYYYYY

ZZZZZZZ

ZZZZZZZ

ZZZZZZZ

END OF MANEUVER MESSAGE

and a reperforator. The message will be verified by the cognizant FPAC engineer, the DSIF Operations Project Engineer, and the Assistant SFOD, and personally approved by the SFO Director and the DSIF Operations Manager.

The DSIF Operations Manager will assign the appropriate code word, frequency designation, and channel designation to the message and send the message (page copy and punched paper tape) to DSIF Net Control. DSIF Net Control will verify to the DSIF Operations Manager that a proper code word has been assigned. DSIF Net Control will then proceed to transmit the message to the proper DSIF station.

b. Verification of Command Maneuver Message by DSIF Stations

Upon receiving the command message from DSIF Net Control, the DSIF command station will retransmit the command message to DSIF Net Control.

NOTE: The DSIF command station should precede the retransmitted message with its standard message heading. This will ensure against ambiguity of identification between the original transmitted message and the retransmitted message.

c. Verification of Retransmitted Maneuver Command Message by DSIF Net Control

Upon receiving the retransmitted message, DSIF Net Control will compare the transmitted and the retransmitted message for verification. DSIF Net Control will verify the retransmitted punched tape by comparing the coded portion with the same portion of the original punched tape. If verification cannot be made on the first retransmission, the station will be required to repeat the retransmission. If verification cannot then be made, a decision will be made in real time as to procedures to be used.

If and when verification is made, DSIF Net Control will notify the DSIF command station by voice and/or TTY. DSIF Net Control will also notify the DSIF Operations Manager of verification.

d. Verification of Maneuver Commands at the DSIF Station

When the DSIF command station has been notified by DSIF Net Control that its reception of the command message has been verified, the command station will proceed to verify the Quantitative Command in the command unit RWV system. This is done by reading into the RWV the last portion of the command message containing the three identical coded Quantitative Commands. The coded commands on the teletype tape are in binary form. See Table IV-I for the ground command word structure and Figure IV-1 for the RWV command message tape format.

e. Transmission of Maneuver Commands to the Spacecraft

At the times specified in the maneuver command message, the DSIF station will transmit the three QC commands and DC-23 and DC-14 commands. DC-27 will not be transmitted until the station receives a "Proceed with Maneuver" message as described below.

1) Procedures for Use of "Proceed with Maneuver" Message

The "Proceed with Maneuver" message will not be initiated by the SFO Director until shortly before the time for command execution so as to permit the greatest amount of time for observing the spacecraft condition relative to the intended maneuver. Under normal circumstances, the DSIF station will not proceed with transmission of the maneuver command prior to receiving this message. The "Proceed with Maneuver" message is shown in the following format:

CODE	F(X. X)	C(YY)
PROCEED WITH MANEUVER MA-C S/C NO_______		

Upon receipt of this message, the DSIF command station will transmit the appropriate command (DC-27) at the time specified in the original command message.

It is possible that the "Proceed with Maneuver" message can be received after the time specified for DC-27. The station will immediately transmit the DC-27 if the "Proceed with Maneuver" message is received within ten minutes of these times. Any "Proceed with Maneuver" message received beyond this ten-minute period will not be acted upon. In the latter case, DSIF Net Control should be immediately contacted for instructions.

2) Command Retransmission

If it is necessary to retransmit one of the Quantitative Commands to the spacecraft, the DSIF command station will be so instructed. The original command will not be retransmitted from DSIF Net Control to the DSIF station. A separate message shall be used for each retransmission required. The retransmit Quantitative Command instruction will be in the following format:

```
CODE        F(X.X)          C(YY)

RETRANSMIT TO MA-C S/C NO__________

QC ONE-________630 XXXXXX Y AT HHMM Z  HHMM Z  HHMM Z
```

2. Special Command Procedures

a. Procedures for Use of DC-13 to Inhibit Maneuver

The nature of the DC-13 command requires special procedures for its use. This command will normally be used only from DSIF 11 (Goldstone).

1) Prepare to Transmit DC Thirteen

The "PREPARE TO TRANSMIT DC THIRTEEN" is included in the Postencounter Command Message (Table IV-IV). After verification has been obtained via spacecraft telemetry that DC-27 has been received by the spacecraft and that the telemetry mode has changed to Mode I, a prepunched DC-13 tape will be loaded into the command unit and verified to ensure the quick reaction required. The use of DC-13 (Inhibit Maneuver) can be made any time prior to start of pitch turn. (The actual GMT times will be indicated in the maneuver command message.) After this time, the tape shall be removed from the command unit.

The order to use DC-13 will be given by voice, using the following message:

```
CODE        F(X.X)          C(YY)

TRANSMIT DC-13 to MA-C S/C NO________
```

Upon receipt of this order, the commanding DSIF station will immediately transmit DC-13 to the spacecraft. If the command cannot be transmitted before the time indicated in the command message, the command shall not be sent.

b. DC-13 Used Prior to Maneuver

1) Should DC-13 be previously utilized to effect the initiation of Canopus Acquisition, DC-14 (which is normally transmitted prior to DC-27), would be transmitted five minutes following the transmission time of DC-27. In this case, the "Proceed with Maneuver" message transmitted to the DSIF station prior to the DC-27 execution, authorizes the transmission to the spacecraft of both DC-27 and DC-14.

3. Spacecraft Command Message

Upon decision to execute a command not included in Paragraphs H. 1. and 2. of this section, the SFO Director will prepare a spacecraft message as shown below:

```
CODE        F(X.X)          C(YY)

XMIT THE FOLLOWING COMMAND(S) TO

     MA-C S/C NO____________

DC-_____6XXXXXXXXX AT HHMM Z HHMM Z HHMM Z

DC-_____6XXXXXXXXX AT HHMM Z HHMM Z HHMM Z
```

NOTE: Times may be replaced with the word, "IMMEDIATELY".

DSIF Net Control will transmit the spacecraft command message to the station manager at the proper DSIF station and will require acknowledgment of receipt of message, verification of command number, and time at which command is to be executed.

Upon receipt of the spacecraft command message, the command will be executed at the time stated in the command message in accordance with the procedures described in the Mariner C TIM, EPD-167.

Upon execution of the commands, the DSIF Station Manager will notify DSIF Net Control what command was transmitted to the spacecraft and the time of transmission. The DSIF Station Manager will include the command and time of transmission in the next station report.

Upon notification by DSIF Net Control, the DSIF Operations Manager will inform the SFO Director by voice that the command has been transmitted and the time of its transmission.

I. SPACECRAFT COMMAND VERIFICATION

1. Maneuver Commands

The reception of the commands by the spacecraft will be verified by observing the incrementing of Event Registers 1 and 2 on Channel 115 and Event Registers 3 and 4 on Channel 116. Each QC will increment Event Register 4 by two (2) and Event Register 2 by one (1). All DC commands will increment Event Register 4 by one (1). (See Table IV-V.)

J. APPROVED ENCOUNTER SEQUENCE COMMANDS

The following sequence of events and commands related to these events are presented as approved by the Mariner Mission Director. If spacecraft, DSN, and SFO performance is nominal, the noted commands can be exercised in the manner shown without additional Project approval.

1. MT-7 is to initiate the encounter sequence.

   Option a) If MT-7 does not function, DC-25 is to be sent as rapidly as is feasible.

2. An attempt to preposition the platform is to be made within MT-7 plus two hours using DC-24.

   Option a) If DC-24 is unsuccessful in stopping the platform, the system will await the functioning of the Wide Angle Acquisition (WAA).

   Option b) If DC-24 is successful at stopping the platform, but at a disastrous angle, then DC-26 will be sent, followed by DC-25 to reinstitute the scan. No additional DC-24s are to be sent and the system will await the WAA.

3. If WAA has not occurred prior to Narrow Angle Acquisition (NAA) -30 minutes, DC-24 should be attempted, whether or not Option 2.a) or Option 2.b) above has occurred.

4. DC-16 should be transmitted to arrive at the spacecraft to satisfy the function of NAA backup and platform positioning simultaneously.

5. Twenty-five minutes after DC-16, DC-26 should be transmitted to back up the tape recorder turnoff.

6. DC-2 should be transmitted one minute after DC-26 to reactivate cruise science.

It must be noted that the above sequence has been agreed upon in order to allow the orderly preparation for encounter. Additions and/or modifications will be made if deemed appropriate.

TABLE IV-V. MARINER '64 MANEUVER EVENT REGISTERS

FUNCTION	NOMINAL TIME	EVENT REGISTERS 1	2	3	4
Pitch, Roll & Motor Burn Quantitative Commands (QC 1-1, 1-2, 1-3)					+2 each
Parity Check of CC&S Command Bits			+1	each QC	
Arm Second Propulsion Maneuver (DC-23)				+1	
Release Pyro Inhibit, if any (DC-14)				+1	
Initiate Maneuver Sequence (DC-27)	M +0			+1	
Turn Gyros On (CC&S M-1)	M +0		+1		
Gyros On	M +0	+1			
Establish Inertial Mode, Start Pitch Turn, Set Turn Polarity [CC&S M-2, M-4, M-3 (+) or M-3 (-)]	M +59 to 60 min.		+1		
Stop Pitch Turn, Reset Turn Polarity (CC&S $\overline{\text{M-4}}$, $\overline{\text{M-3}}$)	≤ 1319 sec. duration		+1		
Start Roll Turn, Set Turn Polarity [CC&S M-5, M-3 (+) or $\overline{\text{M-3}}$ (-)]	M +81 to 82 min.		+1		
Stop Roll Turn, Reset Turn Polarity (CC&S $\overline{\text{M-5}}$, $\overline{\text{M-3}}$)	≤ 1319 sec. duration		+1		
Start Motor Burn (CC&S M-6)	M +103 to 104 min.		+1		
Firing Current to Start Propulsion Squibs	M +103 to 104 min.	+1		+1	

(This table continued on next page.)

TABLE IV-V. (CONT'D)

FUNCTION	NOMINAL TIME	EVENT REGISTERS 1	2	3	4	
Stop Motor Burn (CC&S M-7)	≤ 102.36 sec. duration		+1			
Firing Current to Stop Propulsion Squibs	≤ 102.36 sec duration	+1		+1		
Commence Automatic Reacquisition (CC&S $\overline{\text{M-1}}$, $\overline{\text{M-2}}$)	M +109 to 110 min.		+1			
Sun Acquired Signal	< M +130 min.				+1	
Turn Off Maneuver Clock	M +198 to 199 min.		+1			

K. COMMAND PROCEDURE FOR AN ENIGMATIC LOSS OF COMMUNICATIONS WITH MARINER IV

The possibility exists that a loss of communications with the spacecraft could occur wherein there would be no indication of the nature of the failure. This event could result from either a sudden loss of the RF signal, for one of several reasons, or one of the tracking stations could be inoperative such that 24-hour tracking is not possible. The spacecraft could have been operating when it set at a station, failed over the inoperative station, and at the rise of the next station, no RF communications could be established.

With a loss of spacecraft signal where no information is available to analyze the possible failure modes, it is necessary to make some engineering assumptions in planning the action to be taken. An ordered series of commands can be transmitted to the spacecraft in an attempt to recover the spacecraft signals after an enigmatic loss in communications. The sequence is arranged in chronological order. A command is transmitted and if DSIF is unable to acquire the spacecraft, the next command in the sequence is transmitted.

A command-correctable loss of the spacecraft RF signal could result from either the radio subsystem or the attitude control subsystem. The first corrective actions should,logically, be concerned with the RF subsystem, for if the problem is not a radio problem, there would be a possibility of degrading the condition of the spacecraft by changing radio modes rather than attitude control modes. It may be possible for a cyclic to rectify any radio problem in an acceptable period of time. If, however, it is decided to use the command sequence, the first four commands should be sent using only the 10 kw transmitters for if the spacecraft's attitude control subsystem is functioning properly, commands can be transmitted to the spacecraft with 10 kw. Therefore, if commands can be received by the spacecraft from the 10 kw transmitters, any command-correctable problem is most likely a radio problem. The last three commands should be sent using only the 100 kw transmitter, for if the spacecraft is not attitude stabilized, the benefits of the interferometer effect will be lost and the 100 kw transmitter will be required to establish a command link to the spacecraft.

Table IV-VI lists the proposed sequence of commands with reasons, remarks, and transmission criteria.

TABLE IV-VI. SEQUENCE OF COMMANDS FOR RECOVERY OF SIGNALS IN EVENT OF AN ENIGMATIC LOSS OF COMMUNICATIONS

SPACECRAFT INITIAL CONDITIONS

Radio: Tx. High-gain, Rx. Low-gain
Exciter-A Power Amp. -A

Attitude Control: Canopus Tracker On
DC-15 in effect

COMMAND	REASON	REMARKS	TRANSMISSION
1. DC-8	Assumed failure in Exciter A.	In the Exciter (Ex.)-A, Power Amp. (P.A.)-A chain, the exciter is assumed the weakest link. Radio mode is now Ex. -B, P.A. -A	As soon as possible
2. DC-7	Assumed failure in Power Amp. (P.A.)-A (TWT).	Radio mode is now Ex. -B, P.A. -B	After DC-8 and the two-way transmission time, plus the time necessary for DSIF to satisfy themselves that they cannot acquire the spacecraft has elapsed.
3. DC-8	Exciter B could have failed while inactive.	Radio mode is now Ex. -A, P.A. -B	After DC-7 and the two-way transmission time, plus the time necessary for DSIF to satisfy themselves that they cannot acquire the spacecraft has elapsed.
NOTE:	Because of the conditions under which the commands in this sequence are transmitted, it is advisable to repeat the transmission of the radio commands. If the radio commands are retransmitted, the sequence should begin with a DC-7. The radio sequence then consists of a series of alternating DC-8 and DC-7 commands.		

(This table continued on next page.)

TABLE IV-VI. (CONT'D)

COMMAND	REASON	REMARKS	TRANSMISSION
4. DC-19	Resets DC-15 and provides gyro rate control, if needed.	The star intensity gate is brought back into operation thereby allowing the tracker to acquire only a select number of objects. The gyro package is also activated if the tracker is not acquired thereby limiting the maximum spacecraft angular rates.	As soon as possible.
5. DC-21	Attempts to reacquire Canopus or some other body that will orientate the spacecraft high-gain antenna towards Earth.	The use of DC-21 should, in most cases, result in the minimum time for positioning the spacecraft high-gain antenna towards Earth if the Canopus tracker is working. Also the DC-19, DC-21 sequence is a proven spacecraft mode of operation for reacquisition.	DC-21s should not be transmitted until an interval of time has elapsed after the transmission of the last DC-19 equal to the two-way transmission time plus the value of time between the last object that the Canopus tracker can acquire before it would acquire Canopus. DC-21s shall be transmitted in groups of three.
6. DC-18	A failure in the Canopus tracker and/ or its associated circuitry prevented proper operation of DC-21.	If a failure exists in the DC-21 circuitry, it is possible that the spacecraft could still be positioned in roll using DC-18.	After transmitting (N-1) groups of DC-21s, where N is equal to the number of acquirable objects counting Canopus, DC-18s should be transmitted at one-minute intervals until either a signal is received from the spacecraft or the spacecraft would have been rotated through 360 degrees. As soon as

(This table continued on next page.)

TABLE IV-VI. (CONT'D)

COMMAND	REASON	REMARKS	TRANSMISSION
6. DC-18 (Cont'd)			the spacecraft signal is acquired, the transmission of DC-18s should stop immediately.
7. DC-21	To cause the spacecraft to perform a neg. roll turn.	If the spacecraft is acquired during the transmission of the DC-18 commands, the spacecraft will overshoot the desired attitude by an amount proportional to the number of DC-18s transmitted before the spacecraft was acquired.	As soon after acquisition of the spacecraft signal as possible, (N-1) groups of DC-21s should be transmitted to the spacecraft. N is defined as the one-way transmission time to the nearest minute.

SECTION V

STANDARD SEQUENCE OF EVENTS FOR ENCOUNTER

A. GENERAL

This section presents the sequence of events planned and expected for standard space flight operations during encounter (Table V-I). This sequence of events deviates from a standard space flight operation as defined during the prelaunch and launch phases in that five commands have been programmed into the sequence (DC-24, DC-3, DC-16, DC-26, and DC-2).

Because of the time element involved at encounter and a round trip transmission time of 24 minutes, DC-24 will be used as the prime instrument for positioning the scan platform, rather than the backup function for which it was originally intended.

B. LEGEND

The following abbreviations and acronyms are used in Table V-I, Mariner IV Standard Sequence of Events for Encounter.

AGCM	Automatic Gain Control Program
BUSS	Spacecraft Performance Analysis Area (SPAA)
BUSS CHIEF	SPAC Director
CA	Closest Approach
COMM	Communications
DACON	Data Processing Controller
DAS	Data Automation System
DAS/SCAN	Data Instrumentation Scan Program
DC	Direct Command
DIS	Data Instrumentation System
DPS	Data Processing System
FPAC	Flight Path Analysis and Command
FLITE	Flight Path Analysis Area (FPAA)
FLITE CHIEF	FPAC Director
GTS	Goldstone Tracking Station
MAR/BUS/SPAA	SPAC Analysis Net (Category 4)
MAR CHIEF	Assistant Space Flight Operations Director
MAR NET	Prime Directive Net (Category 1)
MAR OPS	Encounter Analysis Control Net (Category 2)
MAR/SPACE/SSAA	Planet Science Analysis (Category 4)
NAA	Narrow Angle Acquisition
OPS 1	Operations Console
RED	Facilities Operations Control Net (Category 3)

SFOD	Space Flight Operations Director
SPACE	Space Science Analysis Area
SPACE CHIEF	Space Science Analysis Director
TDP/ODG/ODP	Tracking Data Processor/Orbit Data Generator/ Orbit Determination Programs
TRACK	Deep Space Instrumentation Facility (DSIF)
TRACK CHIEF	DSIF Director
TRAJX	Trajectory Program
T/M	Telemetry
WAA	Wide Angle Acquisition
XA	Transmitter Frequency

TABLE V-I. STANDARD SEQUENCE OF EVENTS

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
	14 July 1965			
1	09:12	OPS 1		1. Run AGCM Program.
2	09:32	51		1. One-way acquisition of S/C by DSIF 51.
		TRACK	RED	1. Report acquisition by DSIF 51.
			51, 42	1. Transfer two-way lock from DSIF 42 to 51.
3	09:35	TRACK	42, 51	1. Request DSIF 42 to turn off their transmitter and DSIF 51 to turn on their transmitter. XA setting at DSIF 51 should be set for entire pass while command modulation is ON.
4	10:05	TRACK	RED	1. Report DSIF 51 in two-way lock with the S/C.
5	11:50	FPAC		1. Run TDP/ODG/ODP.
6	12:30	SPACE	MAR OPS	1. Inputs of expected scan performance to FPAC.
7	12:50	FPAC	RED	1. TRAJX
8	12:51	42		1. DSIF 42 - end of track.
9	12:53	ALL		1. All personnel on station in SFOF for encounter.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
10	12:55	TRACK	RED	1. Report DSIF 42 end of track.
11	13:00	FPAC	RED	1. Run fly-by fine print.
12	13:20	ALL	MAR OPS	1. All stations report status to Mar Chief with a GO/NO-GO indication. If NO-GO, give reason.
		TRACK	51	1. Instruct DSIF 51 to tune to new XA for time 16:00 GMT.
13	13:35	51	51	1. Report XA change complete.
14	13:40	TRACK	51	1. Begin normal pre-command modulation, turn-on procedure with DSIF 51.
15	14:00	BUSS	MAR OPS	1. Give command modulation turn-on status, recommend $8f_s$ last two digits.
		FLITE CHIEF	MAR OPS	1. Report best time for DC-25 to have scan intercept planet properly.
		OPS 1	RED	1. Perform A_0 and user program processing for science data received up to this date. Distribute by 16:00 GMT.
16	14:05	TRACK	51	1. Instruct station to turn on command modulation at proper $8f_s$ offset.
		TRACK CHIEF	RED, MAR NET	1. Report command modulation turn on.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
17	14:30	BUSS	MAR OPS	1. Verify command modulation ON. (Command $8f_s$ is <u>not</u> normalized.)
18	14:45	BUSS	MAR OPS	1. Inform Mar Chief of the command status.
19	15:00	ALL	MAR OPS	1. All stations report status to Mar Chief with a GO/NO-GO indication. If NO-GO, give reason.
		MAR I/O		1. Initialize science encounter formats. a. MSA - Space Chief 3070 Science Quick-Look DAS 3070 - F-35 30 x 30 Plotter F-17, 180 sec/in. b. SSAA - 3070 Science Quick-Look 30 x 30 Plotter F-18, 180 sec/in. 2. Disable all science alarms.
20	15:15	SFOD	MAR NET	1. Report general status to Project Manager.
21	15:30	TRACK	51 61	1. Request DSIF 51 and DSIF 61 to switch GTS printer from PROGRAMMED to ALL.
22	15:53:49	51	51	1. MT-7. Report event to TRACK when observed at station and give time.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
	15:53:49 (Cont'd)	TRACK CHIEF	MAR OPS, RED	1. Announce time DSIF observed the event.
		BUSS, SPACE	MAR OPS	1. Report event to Mar Chief. a) Counter 1 and 2 events. b) Encounter power on. c) Confirm scan platform motion. d) Report tape recorder electronics on.
23	15:54	SFOD	MAR NET	1. Option for nonstandard MT-7 event (at 15:59 GMT). a) Buss will recommend DC-25. b) SFOD will instruct TRACK to have DSIF 51 transmit DC-25. c) At 15:59 GMT, Track Chief will instruct DSIF 51 to transmit DC-25 at a specified time.
24	15:55	SFOD	MAR NET	1. Report status of MT-7 to Project Manager.
25	15:57	BUSS	MAR OPS	1. Report command status to Mar Chief.
26	15:59	TRACK CHIEF	51	1. If MT-7 has not occurred, instruct DSIF 51 to transmit DC-25 at a specified time.
27	16:00	FPAC	RED	1. Run TDP/ODG/ODP (94Y).

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
28	16:10	OPS 1	RED	1. Run DAS-SCAN (94X).
		ALL	MAR OPS, RED	1. All stations report status to Mar Chief with a GO/NO-GO indication. If NO-GO, give reason.
29	16:25	BUSS	MAR OPS	1. Report results of DC-25, if transmission was required.
		OPS 1	RED	1. Run DAS-SCAN (94X).
30	16:30	SFOD	MAR NET	1. Report results of DC-25 to Project Manager (if DC-25 was required).
31	16:40	OPS 1	RED	1. Run DAS-SCAN (94X).
32	16:55	OPS 1	RED	1. Run DAS-SCAN (94X).
33	17:00	ALL	MAR OPS, RED	1. All stations report status to Mar Chief with a GO/NO-GO indication. If NO-GO, give reason.
34	17:10	OPS 1	RED	1. Run DAS-SCAN (94X).
		FPAC	RED	1. Run TRAJX (94Y).
35	17:20	SPACE	MAR OPS	1. Report results of DAS-SCAN to Mar Chief.
36	17:25	OPS 1	RED	1. Run DAS-SCAN (94X).
37	17:30	FPAC	RED	1. Run fly-by fine print (94Y) for use in fly-by fine run.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
38	17:40	OPS 1	RED	1. Run DAS-SCAN (94X).
		FLITE, COMM, DPS, TRACK		1. Transmit sample predicts to GTS/ DIS.
		SPACE	MAR OPS	1. Report time for transmission of DC-24.
		SFOD	MAR NET	1. Report to Project Manager on status of DC-24.
39	17:48	BUSS CHIEF	MAR NET	1. Request SFOD to have DC-24 transmitted at ______ H ______ M ______ S.
40	17:49	BUSS	MAR OPS	1. Report command status.
		SFOD	MAR NET	1. Request Track Chief to have DSIF 51 transmit DC-24 at ______ H ______ M ______ S.
41	17:50	TRACK CHIEF	51	1. Request DSIF 51 to transmit DC-24 at ______ H ______ M ______ S. NOTE: If for any reason, DSIF 51 is unable to transmit DC-24 at the time specified, DO NOT TRANSMIT. Wait for another transmission time. This command message will be transmitted by voice and followed by TTY message.
		FLITE	MAR OPS	1. Report expected time of closest approach, WAA and NAA based on latest orbit. Also report uncertainties in time for WAA and NAA.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
42	17:54	TRACK CHIEF	MAR OPS, MAR NET, RED	1. Report DC-24 initiate time given by DSIF 51.
		OPS 1	RED	1. Run DAS-SCAN (94X).
43	18:00	FPAC	RED	1. Run TDP/ODG/ODP.
		ALL	MAR OPS, RED	1. All stations report status to Mar Chief with a GO/NO-GO indication. If NO-GO, give reason.
		GTS/DIS		1. Run open-loop receiver prediction program using sample predicts.
44	18:15	GTS/DIS		1. Run pseudo-residual program using sample predicts and transmit residuals to SFOF.
45	DC-24 +25M	BUSS	MAR OPS	1. Report Counter 4 event and scan power status, when observed in data, to Mar Chief.
		SPACE	MAR OPS	1. Report scan motion status to Mar Chief. If stopped, report the position and the value of the position relative to TV data. Options: a. If DC-24 is unsuccessful in stopping the platform, the system will await the functioning of Wide Angle Acquisition (WAA).

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
	DC-24 +25M (Cont'd)			b. If DC-24 is successful in stoping the platform but at a disastrous angle, a recycle procedure will be executed using DC-26 and DC-25. No additional DC-24s will be sent and the system will await WAA.
46	18:20	SFOD	MAR NET	1. Report status of DC-24 action to the Project Manager.
47	18:50	FLITE, COMM, DPS, TRACK	11, 42	1. Predicts for Stations 11, 12, 13, and 42 to be transmitted.
48	19:00	ALL	MAR OPS, RED	1. All stations report status to Mar Chief with a GO/NO-GO indication. If NO-GO, give reason.
49	19:10	FPAC	RED	1. Run TRAJX Program (94Y).
50	19:14	OPS 1	RED	1. Run AGCM Program (94X).
51	19:20	SPACE	MAR OPS	1. Report results of DAS-SCAN to Mar Chief.
		BUSS, SPACE, SFOD	MAR NET	1. Discuss possible command conditions.
		SFOD		1. If no command conditions exist, instruct Track Chief to begin preparation of S/C transfer to DSIF 11.
		TRACK		1. Instruct DSIF 51 to tune to new XA for time 20:10 GMT and to turn off command modulation.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
52	19:34	11		1. One-way acquisition of S/C by DSIF 11. Start sending tracking and T/M to SFOF via TTY.
53	19:36	TRACK CHIEF	MAR NET, MAR OPS, RED	1. Report S/C acquisition time of DSIF 11.
54	19:40	TRACK CHIEF	MAR OPS	1. Report DSIF 51 command modulation turn-off time.
		GTS/DIS		1. Run pseudo-residual program using regular predicts and transmit residuals to SFOF.
55	19:50	FLITE	MAR OPS	1. Report results of latest orbit and the expected time of closest approach (CA), Wide Angle Acquisition (WAA), and Narrow Angle Sensor (NAS) with tolerances.
56	20:08	BUSS	MAR OPS	1. Verify command modulation OFF.
57	20:10	TRACK	11, 51	1. Transfer two-way lock from DSIF 51 to DSIF 11.
58	20:15	TRACK	11	1. Instruct DSIF 11 to begin blind XA change for time 00:00 GMT.
59	20:30	11	11	1. Report XA change complete.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
60	20:35	TRACK	MAR OPS	1. Report verification of two-way lock by DSIF 11.
		TRACK CHIEF	11	1. Begin pre-command modulation turn-on procedures with DSIF 11. 2. XA should be at 62.5 DN.
61	20:53	51	51	1. End of track.
		TRACK	MAR OPS, RED	1. Report DSIF 51 end of track.
62	20:55	BUSS	MAR OPS	1. Verify S/C is in condition for turn-on of command modulation. Report proper $8f_s$ for command modulation.
		SFOD	MAR NET	1. Request Track to have DSIF 11 turn on command modulation.
63	21:00	TRACK	11	1. Request DSIF 11 to turn on command modulation.
		OPS 1, FPAC	RED	1. Run TDP/ODG/ODP.
64	21:05	S/C		1. Would nominally penetrate magnetosphere the size of Earth's if such exists at Mars.
65	21:10	TRACK	MAR NET, MAR OPS	1. Report time DSIF 11 turned on command modulation.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
66	21:20	SPACE 1	MAR, SPACE	1. Evidence in T/M data for magnetosphere as large as Earth's? If no evidence, radiation hazard unlikely. Report to SPACE.
67	21:30	BUSS	MAR OPS	1. Verify that command modulation is ON with correct $8f_s$ offset. (Command $8f_s$ is <u>not</u> normalized.)
		ALL	MAR OPS, RED	1. All stations report status to Mar Chief with a GO/NO-GO indication. If NO-GO, give reason.
68	21:45	BUSS	MAR OPS	1. Report command condition to Mar Chief.
69	21:50	FLITE, COMM, DPA, TRACK	11, 42	1. Predicts sent to DSIF 11, 12, 13, and 42.
70	22:00	OPS 1, FLITE	RED	1. Run TRAJX. Science report to FPAC the latest scan parameters to use.
		BUSS	MAR NET	1. Report to SFOD transmission time of DC-3. ______H ______M ______S.
71	22:05	SFOD	MAR NET	1. Request Track Chief to have DSIF 11 transmit DC-3 at NAA -2 hours. ______H ______M ______S.
72	22:10	TRACK CHIEF	11	1. Request DSIF 11 to transmit DC-3 at ______H ______M ______S.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
73	22:20	TRACK CHIEF	MAR NET, MAR OPS, RED	1. Report DSIF 11 transmission of DC-3.
		OPS 1, FPAC	RED	1. Run fly-by fine print.
74	22:30	OPS 1		1. Perform A_0 and user program processing on science data received since 14:00 GMT (distribute by 23:00 GMT).
		ALL	MAR OPS, RED	1. All stations report status to Mar Chief with a GO/NO-GO indication. If NO-GO, give reason.
75	22:45	SPACE	MAR OPS	1. Confirm Mode 3 data.
		MAR I/O	RED	1. Instruct Data Chief to process Mode 3 data.
76	23:00	FPAC	MAR OPS	1. Report results of latest orbit and expected time of CA, WAA, NAA, and the tolerances.
77	23:12	SPACE 1	MAR, SPACE	1. If no evidence of magnetosphere by now, there is no radiation hazard. Report to Space.
78	23:30	OPS 1, FLITE	RED	1. Run TDP/ODG/ODP.
		ALL	MAR OPS, RED	1. All stations report status to Mar Chief with a GO/NO-GO indication. If NO-GO, give reason.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
79	23:50	S/C		1. WAA occurred at the S/C.
	15 July 1965			
80	00:02	SFOD	MAR NET	1. Report status of WAA to Project Manager.
81	00:08	BUSS	MAR NET	1. Inform SFOD of DC-16 transmission time. ______H ______M ______S.
		SFOD	MAR NET	1. Request Track Chief to transmit DC-16 at ______H ______M ______S.
		TRACK	11	1. Request DSIF 11 to transmit DC-16 at ______H ______M ______S.
82	00:14	TRACK	MAR NET, MAR OPS, RED	1. Report initiate time of DC-16 by DSIF 11.
83	00:15	OPS 1	RED	1. Run DAS 1.
84	00:20 (Nominal)	S/C		1. NAA at S/C.
		SFOD	MAR NET	1. Request Track to have DSIF 11 transmit DC-26 at ______H ______M ______S or before, followed by DC-2 at ______H ______M ______S with the DC-2s to continue on ____ minute centers until notified to stop.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
85	00:22	TRACK	11	1. Request DSIF 11 to transmit DC-26 at ______ H ______ M ______ S with DC-2 to follow at ______ H ______ M ______ S and DC-2s to continue on ____ minute centers until notified to stop.
86	00:25	S/C		1. DC-16 arrives at S/C.
87	00:32	SPACE	MAR OPS	1. NAA seen in data.
		SPACE	MAR NET	1. New time for DC-26 is ______ H ______ M ______ S.
		SFOD	MAR NET	1. Request Track Chief to transmit DC-26.
88	00:37	BUSS	MAR OPS	1. Verify DC-16 (counter event).
		TRACK CHIEF	11	1. Request DSIF 11 to transmit DC-26 immediately.
89	DC-16=0	11		1. Transmit DC-26.
90	DC-16+1M	11		1. Transmit DC-2 and continue to transmit DC-2s on ____ minute centers until notified to stop.
		TRACK CHIEF	MAR NET, MAR OPS, RED	1. Report to SFOD that DC-26 and DC-2 have been transmitted.
91	NAA+25M	S/C		1. TV recording sequence complete at S/C.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
92	DC-16+12M	S/C		1. All science and 400 cps inverter off at S/C.
93	DC-16+13M	S/C		1. Cruise science on at S/C.
94	NAA+49M	MAR I/O	RED	1. Mode 2 seen in data.
				2. Request Data Chief to process Mode 2 data.
95	01:02	S/C		1. Time of Closest Approach (TCA) at S/C.
		BUSS, 11	MAR OPS	1. Verify science ON. Request DSIF 11 stop transmitting DC-2.
96	01:03	MAR OPS		1. Initialize 30 x 30 plotters in MSA and SSAA for cruise mode. F-16 (1800 sec/in.)
97	01:15	OPS 1	RED	1. Run AGCM and DAS 1.
98	01:20	OPS 1	RED	1. Run TRAJX to predict occultation times from latest orbit.
				2. Transmit predicts to DSIF 11, 12.
99	01:30	GTS		1. Compute synthesizer settings and transmit to DSIF 11, 12.
100	01:37	TRACK	MAR NET	1. Inform SFOD of acquisition by DSIF 42.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
101	01:50	11, 12, 42		1. Begin taking 1 sec/10 sec doppler.
		GTS/DIS		1. Stop pseudo-residual program.
				2. Load open-loop receiver program and compute open-loop predicts.
102	01:58	TRACK	11	1. If command condition does not exist, instruct DSIF 11 to turn off command modulation.
103	02:00	ALL	MAR OPS, RED	1. All stations report status to Mar Chief with a GO/NO-GO indication. If NO-GO, give reason.
		ALL		1. Last time for command to get into S/C.
		GTS/DIS		1. Load pseudo-residual program.
		OPS 1	RED	1. Run TDP/ODG/ODP.
104	02:04	GTS/DIS		1. Start computation and transmission of occultation residuals.
				2. Remove mean from residuals.
				3. Set S. S. #3.
		11, 12		1. Start open-loop recorders.
105	02:12	S/C		1. S/C enters occultation region.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
106	02:24			1. Loss of RF signal at Earth. NOTE: Upon exit from occultation, the command loop will not be locked-up unless a non-standard condition is found to exist. In such an event, directions will be given at that time.
		GTS/DIS		1. Stop computation of residuals.
		11, 12, 42		1. Stop taking 1 sec/10 sec data. 2. Turn off tape punches.
107	02:26	GTS/DIS		1. Rewind residual tape and transmit 1 sec pseudo-residuals.
108	02:29	11, 12		1. Turn off open-loop recorders.
109	02:30	FPAA, 11, 12, 13		1. Check frequencies with TDA for Station 13 XA setting and all one- and two-way receiver settings. 2. Change paper tape at Stations 11, 12, and 42. 3. Change open-loop recorder tapes at Stations 11 and 12.
110	02:45	TRACK	13	1. Request DSIF 13 to turn on the 100 kw transmitter.
111	03:02	GTS/DIS		1. Load open-loop receiver program.
112	03:05	S/C		1. S/C exits occultation region.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
113	03:10	OPS 1	RED	1. Run TRAJX.
		GTS/DIS		1. Load pseudo-residual program.
114	03:12	11, 12		1. Start open-loop recorders.
115	03:17	11, 12, 42		1. RF signal observed at Earth. 2. Start doppler punches at reacquisition of signal at 1 sec/10 sec sample. 3. DSIF acquired the spacecraft three-way.
		GTS/DIS		1. Start computation and plotting doppler residuals.
		SPACE	X	1. Report encounter science off to Buss Chief.
		11	11	1. Report exact time from CDC recordings of DSIF 11 receiver in two-way lock.
		TRACK	MAR NET	1. Report acquisitions to SFOD.
116	03:37	GTS		1. Stop computing doppler residuals and begin computing cumulative doppler residuals.
		11, 12		1. Turn off open-loop recorders.
117	03:45	11, 12, 42		1. Stop taking 1 sec/10 sec doppler and start taking 10 sec/60 sec doppler.
		13, 11		1. Transfer S/C two-way to DSIF 11.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
118	04:00	OPS 1	RED	1. Perform A_o and user program processing for science data received since 22:30 GMT (distribute by 05:00 GMT).
119	05:13:51	BUSS	MAR OPS	1. Report MT-8 event to Mar Chief.
120	05:14	SFOD	MAR NET	1. Report MT-8 event to Project Manager.
		TRACK	11,42	1. Direct two-way transfer to DSIF 42.
121	05:20	MAR I/O		1. Enable all science alarms.
122	06:00	OPS 1	RED	1. Run TDP/ODG/ODP.
123	06:24	11		1. DSIF 11 lost S/C on horizon. 2. End of pass.
		TRACK	MAR OPS, RED	1. Report loss of S/C by DSIF 11 to Mar Chief.
124	08:10	OPS 1	RED	1. Run TRAJX program.
125	09:00	OPS 1	RED	1. Run fly-by fine print.
		ALL	MAR OPS, RED	1. All stations report status to Mar Chief with a GO/NO-GO indication. If NO-GO, give reason. 2. Patch DSIF 51 to Building 168. Prime station should be patched to Building 168 automatically until playback is complete.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
126	09:10	OPS 1	RED	1. Run AGCM Program.
127	09:30	51	51	1. DSIF 51 has acquired the S/C.
				2. Start sending RT tracking and T/M to SFOF via TTY.
128	10:00	OPS 1	RED	1. Run TDP/ODG/ODP.
129	11:21	BUSS	MAR OPS	1. Request DSIF 51 go one-way.
		MAR CHIEF	X	1. Request Track to have DSIF 51 go one-way.
		TRACK	51	1. Instruct DSIF 51 to turn off transmitter.
130	11:41	S/C		1. MT-9 at S/C.
131	11:45	BUSS	MAR OPS	1. Verify one-way lock.
132	11:53	BUSS	MAR OPS	1. Report MT-9 event to Mar Chief.
		MAR OPS	RED	1. Instruct Data Chief to switch to processing Mode 1 data.
133	12:00	OPS 1	RED	1. Perform A_o and user program processing on science data received since 04:00 GMT (distribute by 15:00 GMT.
				2. Link station should be manned and equipment on standby by 12:00 GMT.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
	12:00 (Cont'd)			3. SC 4020 should be manned and on standby. 4. Ranger programmer should be in MSA.
134	12:38	MAR CHIEF	X	1. Request Mode 4 processing.
135	12:41	S/C		1. Mode 4 data at S/C. 2. Start of picture No. 1.
136	12:48	42		1. DSIF 42 lost S/C over horizon. 2. End of track.
137	12:53			1. Mode 4 seen in data.
138	13:15			1. Process Mode 4 data to give decimal and 4020 display.
139	13:30			1. Process Mode 4 data to give decimal and 4020 display.
140	13:45			1. Process Mode 4 data to give decimal and 4020 display.
141	14:00			1. Process Mode 4 data to give decimal and 4020 display.
142	15:00			1. Process Mode 4 data to give decimal and 4020 display.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
143	17:00			1. Process Mode 4 data to give decimal, link, and 4020 display. (Link tape must be previously degaussed.)
144	19:00			1. Process Mode 4 data to give decimal and 4020 display.
145	19:12	OPS 1	RED	1. Run AGCM Program.
146	19:32	11		1. DSIF 11 has acquired the S/C. Start RT tracking and T/M to SFOF via TTY.
147	20:51	51		1. DSIF 51 lost S/C over horizon. 2. End of track.
148	21:20	TRACK		1. Instruct DSIF 11 to turn on their transmitter (two-way during Mode 1).
149	21:28			1. End of picture No. 1.
150	21:29	MAR OPS	RED	1. Instruct Data Chief to process Mode 1 data.
151	21:30			1. Process Mode 4 data to give decimal and Link display (Link tape must be previously degaussed). 2. Link film should be available before start of next picture.

TABLE V-I. (CONT'D)

ITEM	TIME OF EVENT (GMT)	STATION	NET	EVENT
152	22:00	ALL	MAR OPS	1. All stations report status to Mar Chief with a GO/NO-GO indication. If NO-GO, give reason.
153	22:30	TRACK	11	1. Request DSIF 11 to turn off their transmitter.
154	23:13	MAR OPS	RED	1. Instruct Data Chief to process Mode 1 data.
155	23:28			1. Start of picture No. 2 playback. NOTE: At this point, if all operations are normal, a semi-cruise operation will be established.

SECTION VI

NONSTANDARD EVENTS

This section has not been written for Mariner IV encounter inasmuch as documentation for non-standard events concerned with this phase of the Mission is presented in EPD-287.

SECTION VII

OPERATING PROCEDURES

The purpose of this section is to formalize certain procedures by means of which the various operational groups will function during the Mariner Mars '64 Mission. These procedures provide for commitments of, and requirements on and between the groups involved in the mission.

A. MISSION AND OPERATIONS CONTROL

1. Organizational Responsibilities

The Project Manager has the responsibility and authority for the execution to completion of the development and operation of the Mariner Mars '64 Mission. Accountable to him is the Space Flight Operations Director (SFOD). The SFOD will advise the Project Manager prior to the implementation of a course of action and will obtain his approval prior to all sequences involving commands sent to the spacecraft, except that the SFOD is authorized to make appropriate decisions requiring action to assure success of the mission if the Project Manager is not available.

In case of nonstandard events, whether Class I, II, III, or IV, a conference will be held between the Directors of the technical analysis groups, the Project Manager, and the SFOD to determine the best course of action. The operating procedures to be used will then be initiated by the SFOD, will have the concurrence of the Project Manager, and will be based on analyses by the technical groups.

During high-activity phases (Launch, Midcourse, Encounter, and major nonstandard events), full support of a maximum SFO staff for the performance of all functions will be required. During the cruise phase, the performance of the Mariner C spacecraft will be monitored 24 hours per day by the DSIF and all data received from the spacecraft will be transmitted to the SFOF. Personnel responsible for quick-look and alarm monitoring will be required to be on duty during these hours.

Procedural instructions required by the DSIF for support of the flight operation will be coordinated verbally between the DSIF Operations Manager and the SFOD. The DSIF Operations Chief directs and controls the DSIF through DSIF Net Control. Additionally, he will report to the SFOD all significant events as well as any difficulties that may occur and their possible effect on the mission.

The SFOF Operations Chief is responsible for the control of the procedures and functions of mission-independent personnel and equipment in the SFOF during the Mariner Mars '64 space flight operations. This responsibility includes the Data Processing System (DPS), the Deep Space Network Ground Communications System (DSN/GCS), and the Facility Support System.

The Data Processing Project Engineer (DPPE) will provide operational control of the Data Processing System. The SFOD will communicate directly with the DPPE in determining the use of computer facilities during critical periods of flight.

It will be the responsibility of the DPPE to control the processing of data and its distribution, via the DPCC, to the various user areas for analysis and display.

The DPPE will notify the SFOF Operations Chief of any problems encountered in the area of data processing, and will supply an estimate of the time required to eliminate any difficulty. The DPPE will notify both the SFOF Operations Manager and the SFOD upon completion of all significant steps in each computer program.

The Communications Coordinator will control the use of JPL internal and external communication lines and will route data over the appropriate line. In case of conflicting requirements, the Communications Coordinator will obtain information on data and communication priorities from the SFOF Operations Manager. The Communications Coordinator will report all communication difficulties by remote display, if possible, or verbally if not. The nature of any failure shall be reported to the SFOF Operations Chief.

Facility support functions are under the direction of the SFOF Operations Chief. It will be his responsibility to ensure that:

1) All SFOF support functions are being performed.

2) Equipment maintenance problems are reported to accountable personnel.

3) The correction of any failure in a support function is expedited.

4) Supplies required during the mission are provided in all areas.

During a mission, failure reports concerning any system supporting the mission shall be made directly to the SFOF Operations Manager.

The FPAC Director will direct the flight operation support for which his group is responsible. He will maintain the required computing operations schedule within the FPAC function. For specific phases of the operation and with the knowledge of the FPAC Director, the SFOD may coordinate activities directly with the head of a specific function within the FPAC.

The FPAC Director will be required to submit a verbal report, upon request, to the SFOD on the status of his functions. Further, it is the responsibility of the FPAC Director to report any significant or anticipated deviations from the scheduled operation. The head of each function within the FPAC shall advise the FPAC Director of any input that is significant to the mission.

The SPAC Director will supervise and coordinate the planned analysis of telemetry data by the subsystem representatives. He will accept special requests for analysis only from the SFOD. The SPAC Director will be required to submit a verbal report, upon request, to the SFOD concerning the status of his area of responsibility. The SPAC Director will also report any spacecraft anomaly or data recovery problems to the SFOD and will describe the expected effect on the spacecraft and any known effects on the mission.

The SSAC Director will coordinate the scientific support of the flight operations. He will be required to submit a verbal report, on request, to the SFOD concerning the status of experiments. The SSAC Director will be prepared at all times to confer with the SFOD on the scientific trade-offs of various mission possibilities.

B. DSIF CONTROL AND OPERATIONS

1. Organizational Responsibilities

a. DSIF Operations Chief

The DSIF Operations Chief is responsible for the operation of the DSIF in support of the Mariner Mars '64 Mission in accordance with commitments made by the DSN office. He will coordinate DSIF activities, as directed by the SFOD, and will provide support to the SFOD in establishing procedures for nonstandard situations.

b. DSIF Project Engineer

The DSIF Project Engineer is responsible for the preparation and distribution of the Tracking Instruction Manual (TIM), the Tracking Operations Memorandum (TOM), and instructions and test schedules for the DSIF stations. He will assist the DSIF Operations Chief and the SFOD in establishing the tracking schedule for the mission. He will also ascertain that committed DSIF stations are properly equipped with mission-dependent equipment and are operationally ready for a mission at a time specified by the DSIF Operations Chief. Lastly, he is responsible for the instruction of the Net Control personnel as to duties and responsibilities for the mission.

c. DSIF Net Control

DSIF Net Control will establish and maintain communications with the DSIF stations as dictated by test and mission schedules. It will coordinate the activities of these stations during actual operational periods by providing a Net Controller for each station.

d. DSIF Advisory Staff

The DSIF Advisory Staff comprises systems engineers for the Ground Radio System, the Tracking Data System, and the Telemetry Data System. The responsibilities of these engineers are to provide full-time coverage during critical periods, and to serve as technical advisors to the DSIF Operations Manager and the Project Engineer. They will also be available during noncritical periods to assist in resolving problems that may arise within the DSIF.

2. Information Required From Other Areas

The DSIF Operations Manager and the Project Engineer shall be periodically advised of the quality of the tracking and telemetry data by a representative of the appropriate analysis area.

Personnel from the appropriate areas will give advance notice of the transmission of predictions to the DSIF and changes in communications commitments to the DSIF Operations Manager and to the Project Engineer.

3. Information Supplied to Other Areas

DSIF Net Control will report, in real time, spacecraft events as reported by the DSIF stations.

DSIF reports (tracking summary, etc.) will be supplied according to a schedule and to a distribution established by the SFOD and the DSIF Project Engineer.

C. FLIGHT PATH ANALYSIS AND COMMAND (FPAC)

1. FPAC Director

The FPAC Director is responsible for the proper execution of FPAC functions. His real time mission responsibilities include scheduling and disseminating information within his group to ensure that outputs of the FPAC function are made available to the appropriate areas. The scheduling responsibility includes placing personnel requirements on the FPAC Operations Heads and arbitrating FPAC computing conflicts in a manner consistent with the desires of the SFOD.

It is the FPAC Director's responsibility to ensure that pertinent FPAC personnel are at all times cognizant of all changes in mission status and/or of all real time decisions, and that appropriate action will be taken when required.

Each FPAC Operations Head is responsible for personally presenting to the FPAC Director the technical inputs that are concerned with the former's area of responsibility, and that are necessary for real time decisions by the SFOD. The FPAC Director will be responsible for presenting this information to the SFOD.

The FPAC Operations Heads will make available to the FPAC Director copies of those portions of their outputs that are significant and will keep the FPAC Director advised as to the status of their respective areas. The FPAC Director will, in turn, as a service to the Operations Heads, explain to the appropriate personnel the contents of any FPAC output and/or the status of the FPAC at any given time.

2. Responsibilities for Orbit Determination

Table VII-I lists the orbits that will be determined during the encounter phase. Also listed is the approximate GMT time and the corresponding PDT.

D. SPACECRAFT PERFORMANCE ANALYSIS AND COMMAND GROUP (SPAC)

1. Organizational Responsibilities

SPAC support during the encounter phase of the Mariner IV Mission shall involve full 24-hour coverage by representatives of each subsystem or applicable discipline beginning approximately 24 hours prior to the turn-on of encounter science, whether by CC&S event or by ground command, and continuing until Data Mode 4 is well established. During the first video data playback portion of the planetary encounter, full support will be available during the periods of engineering telemetry between pictures, and SPAC Division representative support will be maintained for the balance of the time. Following the end of the first complete playback, SPAC support requirements may be relaxed to cruise phase requirements if conditions warrant, pending the concurrence of the Project Manager.

2. Operational Procedure

The onboard spacecraft logic provides for an encounter sequence started via CC&S command, effected by internal logic and sensors, and terminated with a switch to the playback mode via CC&S command. It is probable, however, that the determination will be made that these onboard events do not constitute the optimum sequence of events for the Mariner IV encounter. As a result, the approved encounter sequence will almost certainly involve the transmission of ground commands, either as a primary or backup means of executing the encounter. The sequence adopted and the SPAC implementation plans will be found in EPD-287, Mariner IV Spacecraft Nominal Encounter Sequence.

E. SPACE SCIENCE ANALYSIS AND COMMAND (SSAC) - ENCOUNTER ADDENDUM

1. Organizational Responsibilities

The Figure VII-1 shows the personnel configuration of the SSAC team to support encounter preparation and operations.

The data team will continue to handle processing and distribution of the data with the added special responsibility for TV data. The latter responsibility is outlined in Paragraph F of this section on TV flight data handling.

TABLE VII-I. AVAILABILITY TIMES OF MARINER IV ENCOUNTER ORBITAL INFORMATION (STANDARD OPERATION)

ORBIT NUMBER	ORBIT NAME	TIME FROM E (COMPLETION TIME)	APPROXIMATE GMT			APPROXIMATE PDT	
1	E1	E -48 Hours	01H	18M	July 13	6:18 PM	July 12
2	E2	E -24 Hours	01H	18M	July 14	6:18 PM	July 13
3	E3	E -12 Hours	12H	18M	July 14	6:18 AM	July 14
4	E4	E - 6 Hours	19H	18M	July 14	12:18 PM	July 14
5	E5	E - 3 Hours	22H	18M	July 14	3:18 PM	July 14
6	E6	E - 2 Hours	23H	18M	July 14	4:18 PM	July 14
7	E7	E - 1 Hour	0H	18M	July 15	5:18 PM	July 14
8	E8	E -30 Minutes	0H	48M	July 15	5:48 PM	July 14
9	E9	E	01H	18M	July 15	6:18 PM	July 14
10	E10	E +30 Minutes	01H	48M	July 15	6:48 PM	July 14
11	E11	E + 1 Hour	02H	18M	July 15	7:18 PM	July 14
12	E12	E + 2 Hours	03H	18M	July 15	8:18 PM	July 14
13	E13	E + 3 Hours	04H	18M	July 15	9:18 PM	July 14
14	E14	E + 6 Hours	07H	18M	July 15	12:18 AM	July 15
15	E15	E +12 Hours	13H	18M	July 15	6:18 AM	July 15

E = Closest Approach time as seen from the received ground signal at approximately 01H 18M, July 15, 1965 GMT.

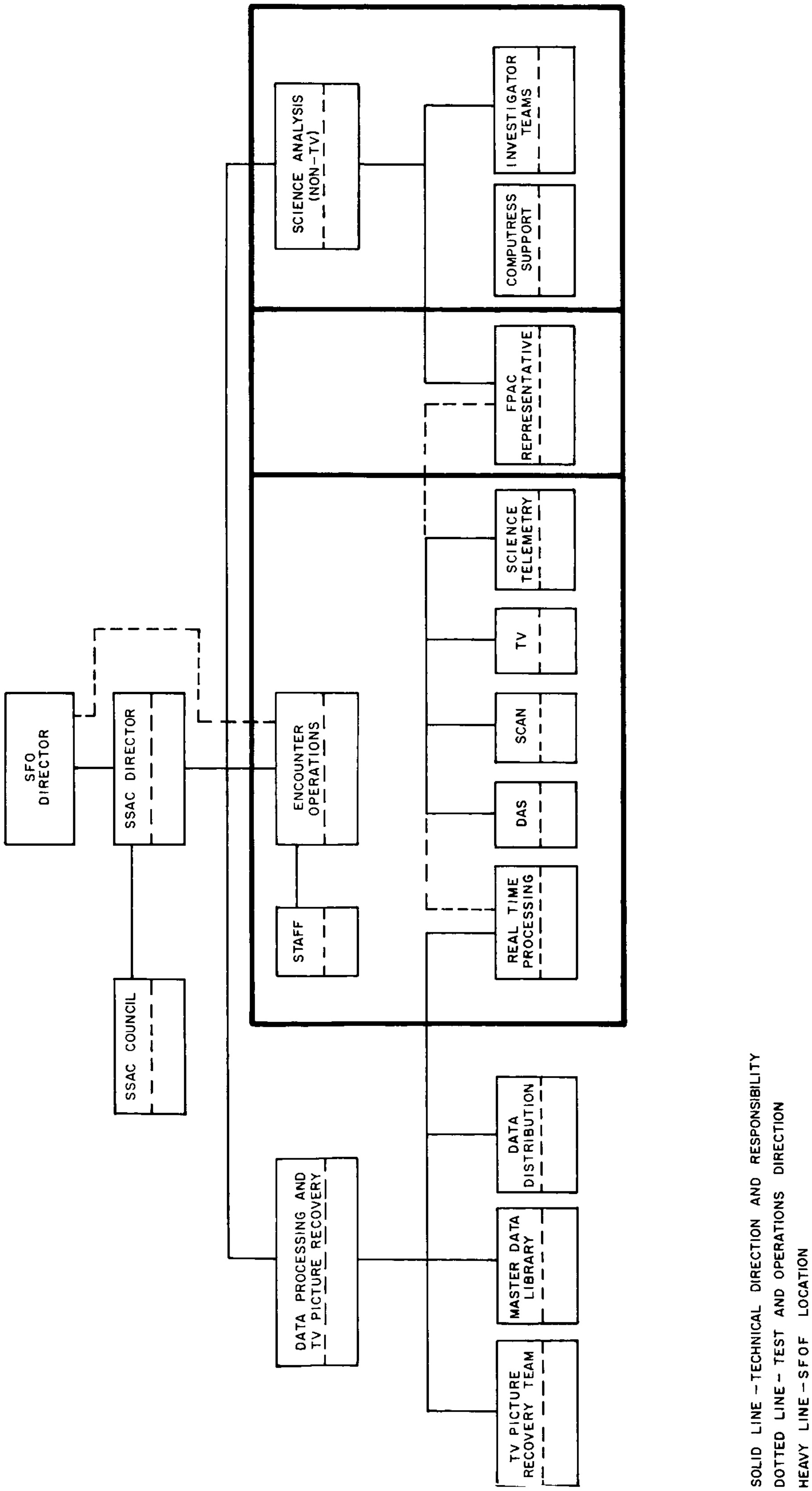


FIGURE VII-1. MARINER SSAC TEAM

The Encounter Operations Group has the responsibility for preparational analysis and operational direction of the mission during encounter. In this capacity, it receives support from DAS, Scan, and TV personnel in addition to real time analysis support from the other experiment teams.

The Science Analysis Group is responsible in assuring adequate support for early analysis of scientific results.

2. Analysis of Scientific Data

It is intended to release preliminary scientific findings within a few days of encounter. Processing of encounter data must be complete within twelve hours of closest approach.

F. TV DATA HANDLING PROCEDURE

1. General

The satisfactory acquisition and processing of the TV data is a primary objective of the Mariner Mission. This operating procedure defines the requirements which must be satisfied by Space Flight Operations in order to achieve this goal.

2. Spacecraft Operations

Two complete playbacks of the picture data from the spacecraft are required. Tracking operations and spacecraft events will be coordinated to minimize data losses. Two-way tracking periods will be initiated during Mode I only and will be terminated prior to the commencing of Mode IV data.

Additional picture playbacks may be requested after evaluation of the data from playbacks one and two. Criteria for additional playbacks are to be established by SSAC prior to encounter.

3. DSIF

a. Coverage

All DSIF stations committed for the Mariner IV encounter phase will track the spacecraft from horizon to horizon for the first tape playback. The second tape playback will be covered by horizon to horizon tracking from the prime stations at each longitude. Additional playbacks will be tracked with reduced overlap, but not less than one hour overlap between prime stations.

b. Acquisition and Recording Procedures

The importance of uninterrupted acquisition and recording of the transmitted data cannot be sufficiently emphasized. In order to enhance the probability of retrieving at least a single error-free continuous stream of TV data, all redundant systems of each station tracking will be in operation. All elements critical to this requirement will be assigned operations personnel for continuous monitoring; specifically included are the antenna drive system, the receivers, and magnetic tape recorders.

The detailed procedures for magnetic tape recorder and paper tape punch operations will be reviewed and verified by the Telemetry Processing Station (TPS). Magnetic tape used will be degaussed and will have been previously recorded over its full length at least one time, but not more than four times. In real time, the playback head signal will drive the decommutator to provide continuous verification of the recording process. Redundant recorders will be phased with the prime recorders to prevent periods of no recording and to maintain maximum time in redundant record. Magnetic tape recorders will be off only for mandatory maintenance and tape changing during a station pass. Magnetic tape recording will be phased to avoid having dual recorders with the same data on the last quarter of the reel.

c. Station Maintenance and Countdown Procedures

Prime stations will transmit a short test sample of simulated TV data from the magnetic tape recorders to the SFOF during the pretrack period. Following the track, the station should verify recorder operation by playing back short segments from the beginning, middle, and end of each magnetic tape from both the pre- and postdemodulated tracks. The procedures describing the pretrack and posttrack verification of the magnetic tape recorders will be rigidly adhered to. Maintenance personnel and equipment for the critical portions of the acquisition and recording subsystem will be on standby at all times during the first and second playbacks. TPS personnel will review each station pass pre- and posttrack station report upon receipt and will report immediately to the SFOD the existence of any anomalous conditions affecting Master Data Library processing.

d. Data Delivery

DSIF will establish fast and secure procedures for delivery of station tapes to JPL. A special courier should be provided to deliver tapes from the first two Johannesburg tracking periods subsequent to beginning of picture playback; these tapes are to arrive no later than twenty-four hours after completion of the second pass.

4. Communications

TV telemetry will be assigned a separate, full-time, tight-tape TTY line for the first and second playback. For the first playback and critical portions of the second, the composite signal will be fed to the redundant demodulator at the stations, and will be transmitted in parallel to the SFOF to be logged by the computer. Batching of this redundant source with administrative and tracking data is permissible. Critical communications coverage should be maintained until a releasable "Mars" picture is received. Maximum use should be made of cable circuits and alternate communication routes. High-speed lines will not be used for TV telemetry. Twenty-four hour administrative communication will be maintained with all stations to keep them informed of mission progress and to permit immediate alerting at JPL if a station encounters difficulties.

5. SFOF

a. Data Transmission

TV telemetry from first and second playback data will be transmitted in real time using a tight-tape loop at the stations. If batch processing is used on a line solely assigned to telemetry, end-of-message indicators and preambles will precede each data batch. If real time transmission is adversely garbled, the data from the pass should be transmitted subsequent to the pass.

b. DPS Support

For first and critical portions of the second playback, dual 7044s will log telemetry data. Until the first three "Mars" pictures are confirmed, the computer system will be in dual Mode II. During the first playback period, the Building 125 computer or a Building 230 (SFOF) Mode IV 7094 must be on instant availability for "Ranger" program processing of flight data. During second playback priority, "Ranger" program processing is required. The TV data programmers will be in Building 230 until the first "Mars" picture is confirmed or until they are released. The "Ranger" programmer will be on a 15-minute call for critical pictures.

The prime computer system should be in telemetry data Mode IV until Mode I data is confirmed and will be switched back to data Mode IV before the Mode I data is completed. The flight TV program will be run at the following times for the first picture and until the nominal playback is confirmed: P +15 minutes; P +30 minutes; P +45 minutes; P +1 hour; P +2 hours; P +4 hours; P +6 hours; P +8 hours 35 minutes (picture completion). After nominal playback is established: P +30 minutes; P +4 hours, picture completion. 7044 log tapes will be recorded such that no picture is on more than one prime log tape. There will be one 7044 prime log tape for each picture. 7044 log tapes containing Mariner IV TV data will have special designators. The tape designators will be defined by the Mariner DPPE. Processing of partial pictures should use a redundant log tape and should not interrupt the prime recording in computer Mode III - Mode IV periods.

SC 4020 derived displays are required for the processing at P +0 to 1 hour, P +2, +4, and +6 hours. Link-derived displays are required for data processed at P +4 hours until first "Mars" picture is confirmed, and at picture completion.

Link tapes will be degaussed save tapes with special designators defined by the Mariner DPPE.

Master Data Library (MDL) processing of station-recorded data should be on an expedited priority basis without interference to MDL processing of cruise or encounter period data.

DPS will prepare SC 4020 outputs as follows:

1) 1 F-80 hard copy

2) 1 film, from which 6 copies should be made by ODC

Tab output will be prepared as follows:

1) Nonbinary output - 3 computer copies and 6 reduced copies

2) Binary output - 1 copy

c. Link Processing

The Link magnetic tape-to-picture converter will be staffed and available to prepare Mariner TV pictures without delay whenever data is available during the first playback period. The following output is required for each picture: 3 negatives and 2 Kalvars.

d. Data Distribution and Control

Logging procedures for all TV data (tapes, IBM tab runs, Link pictures, 4020 pictures) will be established to permit control over data distribution. The data flow plan must be adhered to with specified couriers assigned for each necessary portion of the flow path. SSAC will provide couriers for monitoring data quality and assuring distribution. A log book will be located at designated control points for couriers and operators to sign for data.

Pictures must be kept in a locked cabinet or physically in control of an assigned courier.

Link tapes will be kept in a locked cabinet in the Link area. All Link waste material will be disposed of. An SSAC representative will carry the Link tapes to the processing area, will observe all processing phases, and will carry the results back to the Mission Support Area (MSA). All Link outputs should be serial numbered, logged, and signed for.

Access control should be assigned to the MSA at least through the first picture playback period. Access control to the Link processing area should be established by means of a guard and a controlled list of authorized persons who are permitted entrance.

TV data control is described in Table VII- II.

Comm Control will be instructed that during encounter and playback, flight data will not be patched outside Building 230 except by the specific direction of the SFOD.

e. Data Display and Interpretation Area

The Mariner MSA Conference Room will be available for experimenter interpretation of the TV data. A guard will be posted at the entrance of the MSA Conference Room.

6. Testing

Operational readiness tests that exercise all aspects of the ground support system will be held at least two weeks prior to encounter. Individual areas will be exercised prior to the full scale test to assure readiness. Meaningful simulated data will be provided for these tests.

TABLE VII-II. PLAYBACK DATA CONTROL TABLE

DATA	STATION	CONTROL METHOD	RESPONSIBLE PARTY	USED BY	DISPOSITION
1. Station Magnetic and Paper Tapes	DSIF	Same as Cruise	DSIF - ODC	MDL, Ops and PIO Backup	Permanent storage by ODC
2. TTY RT Signal	DSIF	Comm Patched	SFOD	DPS, Telecomm, Ops, SSAC	Same as Cruise
3. Franklin Printer	Telecomm Rack	Physical Possession	Division 33	Division 33	Division 33 storage
4. TTY Tabs	Ops	Same as Cruise	SFOD	Ops, SSAC	Same as Cruise
5. 3070 Tabs	DPS	Physical Possession	SSAC	SSAC	SSAC storage
6. Off-line Tabs	DPS	Same as Cruise	SFOD	SSAC	Master to ODC. Copies stored by recipient
7. F-80	DPS	Escorted by SSAC Representative	SFOD	SSAC	User storage
8. 4020 Films	DPS	Physical Possession	SFOD	SSAC	Master to ODC. Copies stored by recipient
9. Ranger Tapes	DPS	Physical Possession	SSAC	SSAC	Stored by SSAC
10. Link Tapes	DPS	Escorted by SSAC Representative	SFOD	Link Processing	Interim storage by Link, finally erased
11. Link Film	Link	Escorted by SSAC Representative	SSAC	SSAC, PIO	Stored by recipient
12. Photo Lab Prints	Photo Lab	Physical Possession and Escorted by SSAC Representative	Photo Lab - SSAC	SSAC - PIO	Stored by recipient